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EXTENDED PARTS REQUIREMENTS AND COST MODEL (PARCOM)

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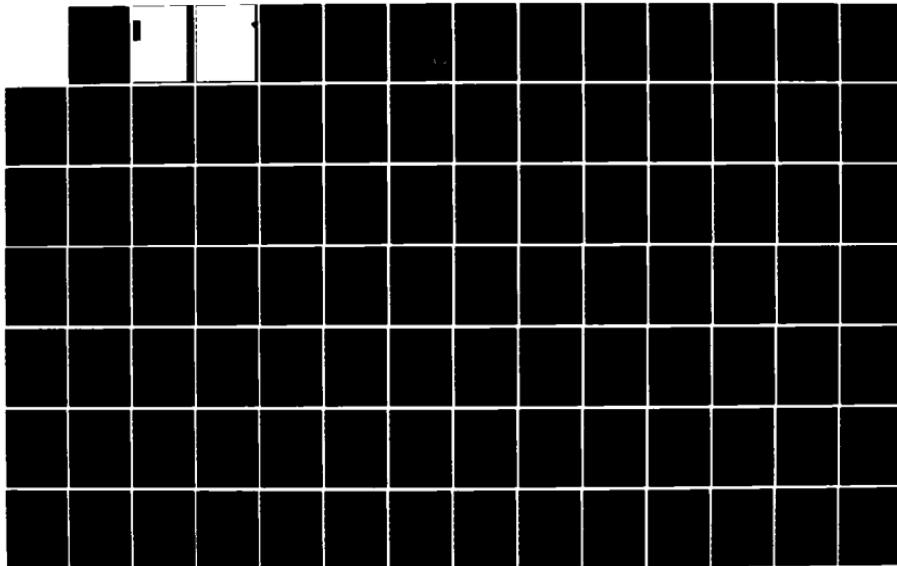
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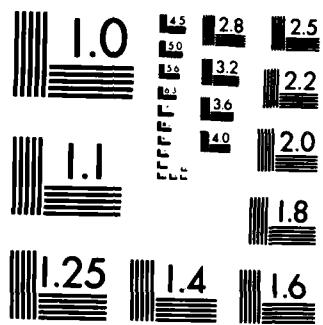
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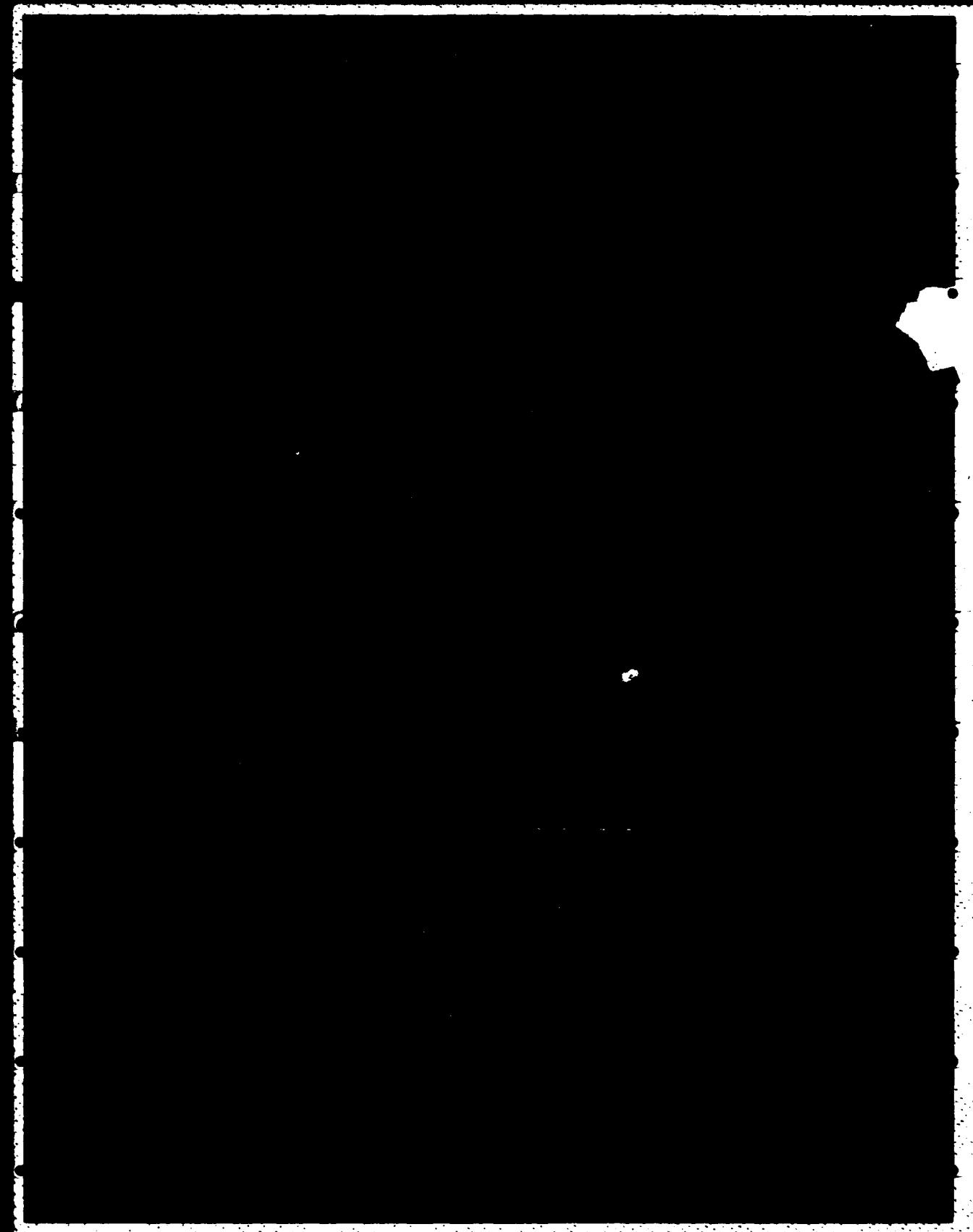
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The basic Parts Requirements and Cost Model (basic PARCOM), developed at the US Army Concepts Analysis Agency, was redesigned to include partial substitution parts replacement policies and other features lacking in the basic PARCOM. The redesigned model is documented and denoted as Extended PARCOM. Extended PARCOM provides the Army with an analytical tool for quick reaction, gross estimation of wartime spare parts requirements and costs as they relate to flying hour and availability objectives and to part replacement policies. The model also assists in the identification of problem parts and possible causes of the		

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problems. The Extended PARCOM Functional Description is structured to provide a user with detailed information on Extended PARCOM model logic and restrictions. Additional information on model application may be found in the Extended PARCOM User's Guide, published separately.

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**EXTENDED PARTS REQUIREMENTS
AND COST MODEL (PARCOM)
FUNCTIONAL DESCRIPTION
(Short title: Extended PARCOM
Functional Description)**

MARCH 1985

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**EXTENDED PARTS REQUIREMENTS AND COST MODEL (PARCOM)
FUNCTIONAL DESCRIPTION**

(Short title: Extended PARCOM Functional Description)

CHAPTER 1

GENERAL DESCRIPTION

1-1. PURPOSE OF THE FUNCTIONAL DESCRIPTION. This functional description of the Extended Parts Requirements and Cost Model (PARCOM) provides:

- a.** The structure of the model logic which will serve as a basis for mutual understanding between the user and the developer.
- b.** Information on model restrictions, potential for extension, and user impacts.

1-2. PROJECT REFERENCES. The reader is directed to the reference list in Appendix B of this document.

1-3. TERMS AND ABBREVIATIONS. The reader is directed to the glossary at the end of this document.

1-4. BACKGROUND

a. Model Origin. The US Army Concepts Analysis Agency (CAA) developed the Parts Requirements and Cost Model (PARCOM) to generate cost-effective mixes of aircraft spare parts and to assess aircraft fleet performance under specified wartime scenario conditions. Development occurred during the course of the Aircraft Spare Stockage Methodology (Aircraft Spares) Study¹ conducted by CAA. That study, and PARCOM development, were in response to interest shown by the Deputy Chief of Staff for Logistics (DCSLOG) in developing a methodology (or methodologies) relating aircraft spare parts stockage levels to combat readiness and flying hour capability. The calculation of spare parts requirements and of the effects of budgeting changes had been a slow and cumbersome peacetime-oriented exercise. The principal criterion for spares stockage had been the achievement of acceptable stockout, or fill rate, levels. To more realistically predict wartime spare parts requirements, and to better justify budget requests for spare parts procurement, the Army needed a more responsive methodology based on wartime flying hour expectations and system readiness/availability requirements. At first, the Army used the Overview Model,^{1,2} but later PARCOM was developed to meet that need.

b. Documentation. Results reported in the Aircraft Spares Study were sufficiently encouraging to warrant a follow-on study designated the Overview/PARCOM Turnkey Project (OPTP).² Included in the objectives of OPTP were the following actions pertaining to PARCOM:

(1) Document PARCOM, as developed in the Aircraft Spares Study, and deliver it to the US Army Aviation Systems Command (AVSCOM). That documentation consisted of a User's Guide³ and a Functional Description.⁴

(2) Evaluate and report on the potential for extending the capability of the PARCOM methodology to include partial-substitution parts replacement policies and any other features deemed desirable but lacking in the version of the model developed for Aircraft Spares. The version of PARCOM developed in OOPTP is denoted as Extended PARCOM, while the Aircraft Spares version is denoted as basic PARCOM. A technical paper⁵ was issued describing Extended PARCOM methodology. This report is a functional description of the new version of the model. An Extended PARCOM User's Guide⁶ has also been prepared.

1-5. STRUCTURE OF ARMY AIRCRAFT LOGISTICS

a. **Governing Regulations.** Policy and procedural guidance for the Army's inventory management efforts is largely contained in two regulations:

- AR 710-1, Centralized Inventory Management of the Army Supply System
- AR 710-2, Supply Policy Below the Wholesale Level

(1) AR 710-1 establishes responsibilities and procedures for centralized inventory management of Army materiel by the major subordinate commands (MSC) of the US Army Materiel Command (AMC).

(2) AR 710-2 prescribes supply procedures to be used at the retail level, including methods for determining authorized stockage lists and appropriate stockage levels.

b. **Maintenance System Structure.** Figure 1-1 illustrates the interaction of supply, maintenance, and industrial activities within the aircraft parts logistics system.

(1) **Parts Storage Locations.** Aircraft spare parts are stored with using units at the aviation unit maintenance (AVUM) and the aviation intermediate maintenance (AVIM) levels. Aircraft spare parts are stored in various CONUS depots for shipment to users upon requisition. Additionally, war reserve parts are stored in various CONUS depots or prepositioned in the appropriate theater.

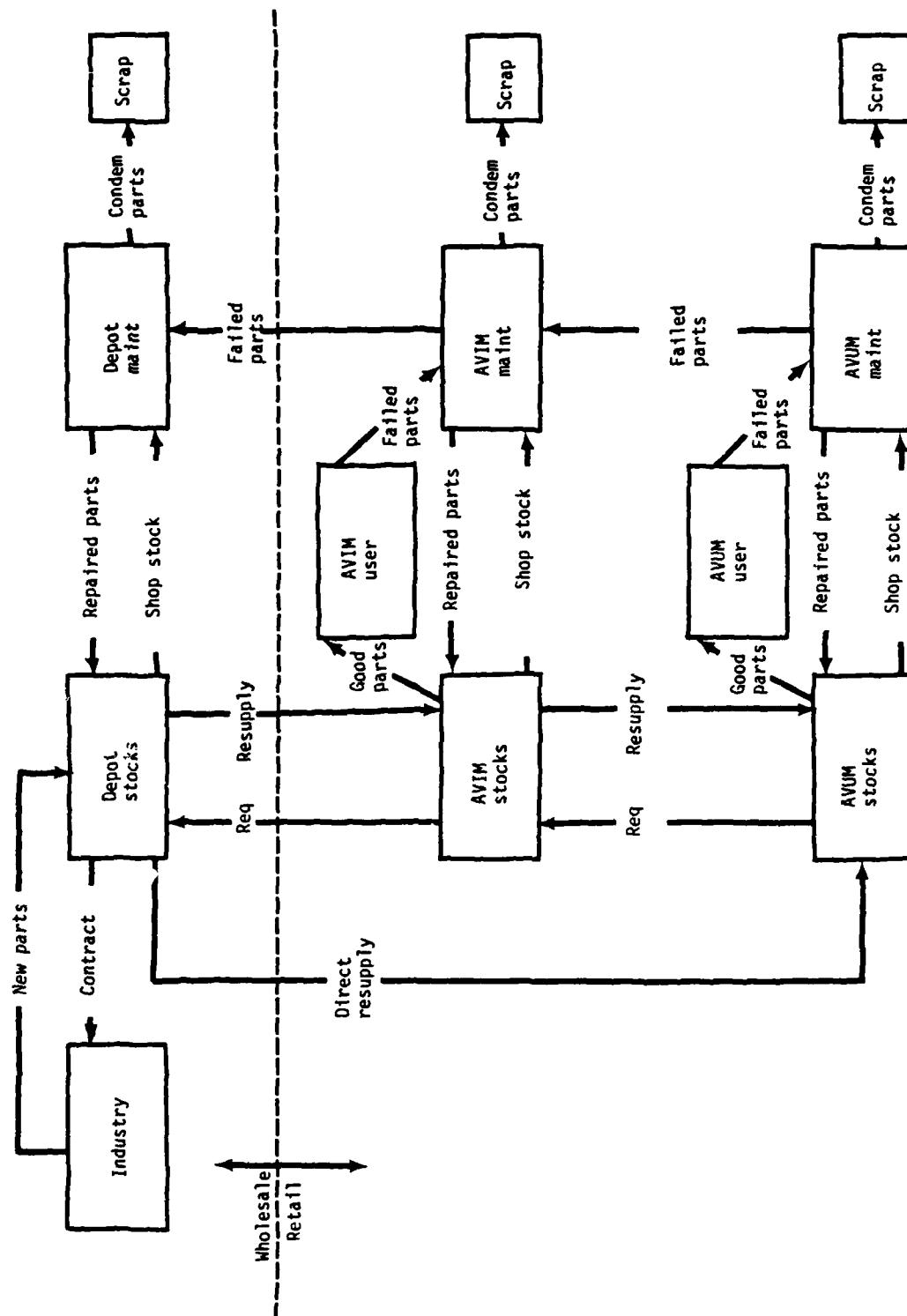


Figure 1-1. Aircraft Parts Logistics System

(2) Participating Organizations and Responsibilities. AVUM facilities are organic to the lower echelon aviation units which actually fly and maintain the Army's aircraft. These user units stock a prescribed load list (PLL) of repair parts at the AVUM level. PLLs are sized to sustain the unit's anticipated wartime flight operations for a specified number of days (usually 15). Stockage levels and reordering procedures are governed by AR 710-2. AVIM units develop their own authorized stockage lists (ASL) based on demands for parts received from supported AVUM units and from their own AVIM operations. AVIM ASLs are exclusive of subordinate unit PLLs. The development of ASLs is also governed by AR 710-2. Part types are selected for PLL and ASL stockage based upon a combination of experienced demand frequency and mission essentiality. The AVIM/AVUM (retail) parts requirements are supported by stocks maintained in supply depots (wholesale) in CONUS. Automated inventory management techniques are employed by AVSCOM to authorize and record fill of retail requisitions by the appropriate wholesale depot. Depot stocks are replenished through procurement of new parts or repair of returned unserviceables.

c. Areas of Consideration

(1) Peacetime versus Wartime. Peacetime requirements for spare parts are computed based upon experienced annual demand and projected peacetime usage. AVSCOM uses an automated system of data bases and models to forecast these requirements, and bases its computations on a supply availability goal. Wartime requirements are computed and funded separately from peacetime requirements, and address those parts required to sustain the force during the initial stages of war until lines of communication and supply can be established. The primary consideration for peacetime requirements is meeting supply availability goals, while that for war reserve requirements is meeting sustainability goals.

(2) Initial Provisioning versus Replenishment. Computation of the spare parts requirement for initial provisioning of new weapons systems is necessarily based on less concrete data than is that for replenishment parts for already fielded systems. No demand history has yet been developed, so engineering estimates of parts failure factors are used instead. In many cases, all the parts to be included in the new aircraft have not been fully identified, and their cost must be extrapolated from that of a list of major assemblies. AVSCOM has an automated capability to compute initial provisioning requirements based on these projected data. Over the first 2 years of a system's life, actual demand data is accumulated and given increasing weight in spare parts management decisions. After a system has been fielded for 2 years, its replenishment spare parts requirements are computed using actual demand data to the maximum extent possible.

(3) Retail versus Wholesale. The Army splits its inventory management into "retail" and "wholesale" activities. In the aviation logistics context, AVUM- and AVIM-level parts stockages are termed "retail," while those at the depot level are termed "wholesale." The methodologies used

to compute spare parts requirements for the retail and wholesale levels are entirely different and essentially unrelated. Retail stockage levels are computed and authorized based upon a combination of demand experience, combat essentiality, and mobility requirements. AR 710-2 establishes computational procedures used by retail parts managers to determine their stockage levels and appropriate reorder points. Wholesale parts requirements are computed based upon average monthly demand experienced at the wholesale level. Wholesale item managers have little visibility of retail spare parts postures or weapons system availabilities. Rather, wholesale parts are procured or repaired at rates calculated to achieve a chosen demand satisfaction percentage without backorders.

(4) Fill Rate versus System Availability Criteria. AVSCOM computes spare parts requirements with the objective of achieving a target fill rate. Its goal is to fill a selected percentage of all demands received without having to backorder parts. The item manager does not base his parts management decisions on weapons system availability, and in fact, has little or no visibility of this retail level criterion. The Department of Defense (DOD) has expressed its support for implementation of system availability-driven parts requirements computation methodologies in all the armed services. The primary difficulty for the Army is the collection of accurate data to drive such automated models.

d. Similarity of Aircraft and Other Spares Procurement. Each of the MSCs uses the Commodity Command Standard System (CCSS) to meet its inventory management responsibilities. The processes used are essentially the same for all types of spares.

1-6. EXTENDED PARCOM REPRESENTATION OF LOGISTICS ENVIRONMENT. The Extended PARCOM "world view" of the aircraft part logistics system is based on the representation in Figure 1-1. Extended PARCOM, however, has only two echelons of stock and repair.

a. Wholesale Level. This level consists of the "depot stocks" and "depot maintenance" blocks of Figure 1-1. Depot maintenance is represented in terms of depot repair times, depot condemnation rates, and order ship times (OST) between depot and retail level. Extended PARCOM treats initial wholesale stocks in four categories. Initial depot serviceables are shipped to theater according to a user-specified schedule. Initial depot unserviceables are repaired or condemned at depot; completed repairs are shipped to theater. Serviceable war reserve stocks are assumed in place in theater. Unserviceable war reserve stocks are treated as failed parts and are condemned or shipped to repair as appropriate.

b. Retail Level. This level is treated as one pool (or "bin") of spare parts stocks consisting of all stocks at AVIM and AVUM levels in Figure 1-1. Retail maintenance is treated as an aggregate process and is represented in terms of retail repair times, not repairable this station (NRTS) percentages, and retail condemnation rates. Essentially, "retail" represents pooled AVIM and AVUM functions. Deploying ASL/PLL stocks arrive in theater according to a user-specified schedule.

c. Distribution of Parts Over Time. Extended PARCOM distributes parts over intervals of 5 days rather than over individual days. All parts due to be received during a given 5-day interval are distributed uniformly throughout that interval. An exception is Day 1 of the scenario. All parts due in (or in place) on Day 1 are treated as received at the beginning of Day 1. The categories of parts treated are:

(1) Depot Serviceables. These consist of serviceable parts located at depot at the start of the scenario. For each part, the initial stock of depot serviceables is entered in the part data base input. The scenario input specifies a depot lag, L , and a depot distribution time, D , applicable to all parts, such that, for each part, the initial stock of depot serviceables is distributed (received at retail) uniformly between Day $(L + 1)$ and Day $(L + D)$.

(2) Depot Unserviceables. These consist of unserviceable parts located at depot at the start of the scenario. They are at various stages of the depot repair process and, after repair, are to be shipped to retail. Since a part may be in any state of its repair cycle, distribution of uncondemned depot unserviceables for each part is assumed uniform over an interval equal to the depot repair time (DRT) for the part, with the first receipt (at retail) after a lag equal to the order ship time (OST) for the part. For each part, the initial stock of depot unserviceables, the depot condemnation rate (DC), the OST, and the depot repair time are input in the part data base. Letting A = number of depot unserviceables, Extended PARCOM distributes $(1-DC) \times A$ repaired parts at retail between Day $(OST + 1)$ and Day $(OST + DRT)$.

(3) War Reserve Serviceables. These consist of serviceable parts in the war reserve located at retail. For each part, the amount of the serviceable war reserve is input in the parts data base. The entire stock is treated as available at retail from the scenario start (Day 1).

(4) War Reserve Unserviceables. These consist of unserviceable war reserve parts located at retail at the start of the scenario. Some of these will be condemned. Others will be sent to depot for repairs. Others are in various stages of repair at retail. The distribution of these parts is as follows:

(a) Items Repairable at Retail. For each part, let NRTS = the NRTS fraction, BR = the retail repair time, BC = retail condemnation rate, and A = number of war reserve unserviceables. Then, Extended PARCOM simulates the receipt in theater, between Day 1 and Day BR, of $(1-NRTS) \times A \times (1-BC)$ parts repaired at retail. All of these factors are input in the parts data base.

(b) Items not Repairable at Retail. For each part, let NRTS = the NRTS fraction, DRT = the depot repair time, DC = depot condemnation rate, OST = the order ship time, and A = number of war reserve unserviceables. Then, Extended PARCOM returns to the theater $(NRTS) \times A \times (1-DC)$ depot-repaired parts between $(2 \times OST + 1)$ and Day $(2 \times OST + DRT)$.

(5) ASL/PLL Deployments. For each part, the Extended PARCOM parts data base inputs on Day 1 include total in-place ASL/PLL parts. In addition, total ASL/PLL parts deployed after Day 1 are input for successive 5-day intervals of the scenario.

d. Users. Users of spare parts are deployed aircraft. Extended PARCOM treats deployed aircraft only at retail level. These are augmented by scheduled deployments of additional aircraft (from a presumed rear area) during the course of a simulated "war." Currently, Extended PARCOM can treat only a homogeneous aircraft fleet of one type for a single force. Deployed aircraft are subject to attrition based on (input) attrition factors. Combat is not explicitly represented.

e. Failure Generation. The deployed aircraft fleet is assigned (via input) a flying hour program, broken into daily fleet flying hour requirements. Extended PARCOM finds a cost-effective mix of spare parts, which, over the course of the "war," will, on average, achieve the set flying program in addition to specified daily aircraft availability requirements. If spares procurement funds are constrained, Extended PARCOM seeks a cost-effective spares mix achieving as much of the flying program as possible. Input failure rates for spare parts are in terms of failures per flying hour. In general, achieved flying hours interact with part failure rates to produce gross part failures. Gross part failures interact with issues from initial spare inventory and the repair process at depot and at retail to produce a net demand for spare parts at user level. The net demand for spare parts at user level then determines the number of surviving aircraft that are mission capable or not mission capable supply (NMCS). As will be seen in the next chapter, Extended PARCOM simulates all interactions in expected value terms, i.e., in terms of the product of an average process rate and the number of items subjected to that process.

1-7. EXTENDED PARCOM PROBLEM SPECIFICATION. The basic purpose of Extended PARCOM is to generate cost-effective mixes of add-on spare parts needed to permit an aircraft fleet of specified type to achieve specified flying program and availability goals under various cost constraints and aircraft availability objectives for a user-specified part replacement policy. These are described below in summary fashion. Additional detail may be found in the Extended PARCOM User's Guide.

a. Cost Constraints. The two cost constraint modes are:

(1) Unconstrained Funds - where unlimited funds for procurement of additional required parts are assumed available.

(2) Constrained Funds - where a cost (funding) limit for add-on spares is set. If unable to meet the flying hour, and possibly, availability objectives with the limited funds, the model generates a "best" solution mix with the funds available, i.e., it seeks to maximize program flying hours achievable within the funding constraint.

b. Parts Replacement Policies. Whether or not a failed critical part degrades aircraft flying hour productivity depends on the parts replacement policy used. Basic PARCOM represented the effects on only two specific policies, full substitution and no substitution. These policies are special cases of the partial-substitution policy capability of Extended PARCOM.

(1) **Full and No Substitution.** Under a no-substitution policy, only a spare may replace a failed part. Under a full-substitution policy, a failed part may be replaced by either a spare or, if a spare is not readily available, by a serviceable part removed from an aircraft which is already NMCS (not mission capable). A third parts replacement policy is "NMCS = 0," which has, as a goal, the replacement of all failed parts with spares. Basically, the "NMCS = 0" policy is just a no-substitution policy with an additional requirement that daily aircraft availability be 1.00. This variation is of interest since it represents the most expensive plausible policy. In a sense, all else being equal, a full-substitution policy is associated with the "cheapest" buy which fulfills the flying program, while the "NMCS = 0" policy is associated with the "most expensive" buy ("covering" all failures with spares).

(2) **Partial Substitution.** In Extended PARCOM, a partial-substitution parts replacement policy is defined by partitioning all part types into a full-sub set and a no-sub set. A part type is in only one set and remains in that set throughout the scenario. The full-substitution and no-substitution policies of the basic PARCOM are special cases of partial substitution in which all parts are either in the full-sub set or in the no-sub set. The analytic usefulness of the definition arises from the consequence that any NMCS aircraft will either be awaiting exactly one no-sub part or at least one full-sub part but will never be awaiting a mixture of full-sub and no-sub parts.

(a) All parts in the full-sub set operate with a full-substitution replacement policy relative to aircraft which are NMCS due to lack of a part from that set. That is, a failed full-sub part on an aircraft may be replaced either by a spare (if available) or by a serviceable part installed on an NMCS aircraft which is awaiting a full-sub part, if a spare is not available. However, no failed full-sub part can be replaced by any part installed on an NMCS aircraft awaiting a no-sub part.

(b) Parts in the no-sub set operate with a no-substitution replacement policy. That is, a failed no-sub part on an aircraft may only be replaced by a spare part. An NMCS aircraft lacking a no-sub part may neither receive a serviceable part from another NMCS aircraft nor provide a serviceable part to (fill a hole in) any other NMCS aircraft.

c. Flying Hour Objective. A flying hour objective is a requirement for the aircraft fleet to achieve a specified number of program flying hours on each day of the scenario. An input flying hour program designates the daily goals. The Extended PARCOM objective is to generate a parts mix which will achieve the specified flying program at least cost.

d. Aircraft Availability Objective. An aircraft availability objective is a requirement for a specific minimum aircraft availability on each day (different days may have different minimum required availabilities). In this context, aircraft availability = 1 - NMCS, where NMCS = the fraction of surviving aircraft in "not mission capable supply" status. An aircraft is in an NMCS status if it is nonoperational because a spare part is needed but is not available to restore it to serviceability. Specification of availability objectives is in addition to the flying hour objective. Specification of a zero availability objective is equivalent to no availability objective at all.

1-8. SUMMARY OF EXTENDED PARCOM OUTPUT. The following are the basic types of print output produced by Extended PARCOM for requirements problems. Details may be found in the Extended PARCOM User's Guide.

a. Unconstrained Cost Cases

(1) Total Requirement. The least-cost parts mix and costs required to achieve the case objectives (flying program and availability) given a zero initial inventory.

(2) Residual Requirement. The least-cost add-on parts mix (to an input initial inventory) and costs required to achieve the case objectives.

(3) Cumulative Cost by Day. For each day N ($N=1, 2, \dots$, through end of "war"), the total and the add-on cost of the full parts requirement to meet the case objectives through day N only, i.e., it is the cost of the requirement for a truncated scenario of N days. Parts mix is not shown.

(4) Cumulative Requirement by Day. For selected parts, for each day N , the cumulative total and residual requirement needed (in the full parts scenario) to meet the case objectives through N days.

(5) Daily Aircraft Available. For each day of the full scenario, the fraction of surviving aircraft which are not NMCS, assuming that the computed solution parts mix is stocked in the theater war reserve.

(6) Daily Flying Hours per Aircraft per Day. For each day of the scenario, the average achieved flying hours per available aircraft per day, assuming that the computed solution parts mix is stocked in the theater war reserve.

b. Constrained Costs

(1) Total Requirement. Total "best" requirements mix, with zero initial inventory, that can be bought with a user-specified funding limit. The principal objective of a "best" mix is to maximize flying hour productivity with the constrained funds.

(2) Residual Requirement. Best add-on (to input initial inventory) requirements mix that can be bought with a user-specified funding limit.

(3) Daily Aircraft Available. For each day of the full scenario, the fraction of surviving aircraft which are **not** NMCS, assuming that the computed constrained cost solution parts mix is stocked in the theater war reserve.

(4) Daily Flying Hour Fraction. For each day of the full scenario, the fraction of the fleet flying program which can be achieved, assuming that the computed constrained cost solution parts mix is stocked in the theater war reserve.

(5) Daily Flying Hours per Aircraft per Day. For each day of the scenario, the average achieved flying hours per aircraft per day, assuming that the computed constrained cost solution parts mix is stocked in the theater war reserve.

1-9. TYPICAL PROBLEMS ADDRESSED. A single Extended PARCOM run can provide answers to several problems pertinent to a given scenario. From the user point of view, typical problem statements, given a specified aircraft deployment schedule, flying program, part replacement policy, and attrition scenario are:

a. What is the least cost add-on buy needed to achieve the flying program and an NMCS fraction not exceeding 0.15 on any day? What is the associated daily NMCS status?

b. With a budget limit of \$10,000,000, what spares should be added to current inventory, using a specified partial substitution policy, to increase to the extent possible the fraction of the flying program achieved? What is the associated daily NMCS status? What is the associated fraction of the flying program that is achievable?

CHAPTER 2

PARCOM LOGIC

2-1. PROCESSING SEQUENCE. Extended PARCOM is a series of expected value simulations of the spare part requirements generation process for cases defined by a combination of parameters noted in the previous chapter. The model determines a cost-effective solution spares mix for each case. In addition, the model computes the capability potential of the force when operated with each computed spares mix. The assessed capability potential is in terms of achievable aircraft availability and fraction of the flying hour program which can be accomplished. Figure 2-1 illustrates the general nature and sequence of Extended PARCOM processing. The basic model sequence, with logic diagrams as appropriate, is described in succeeding paragraphs.

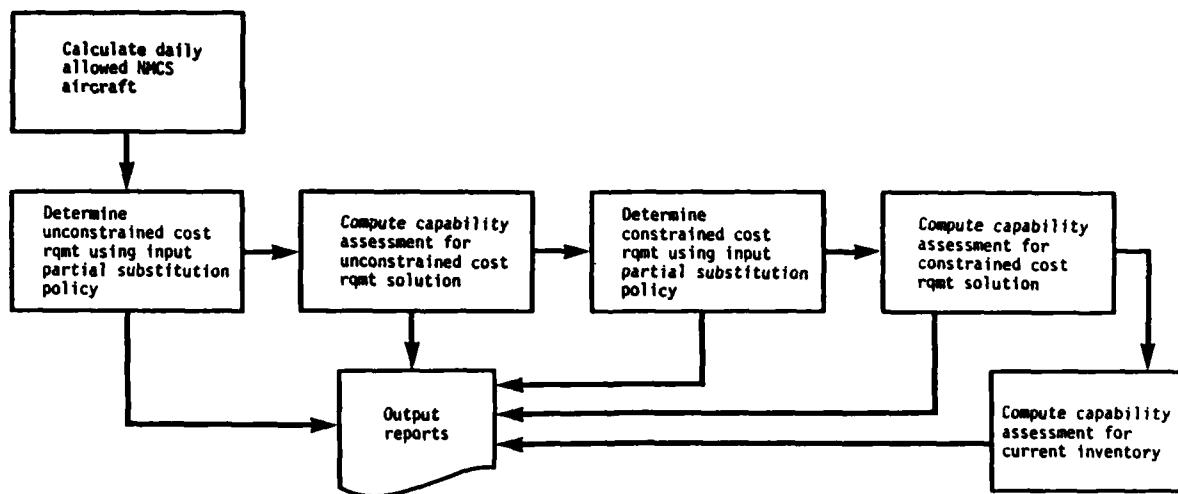


Figure 2-1. Extended PARCOM Processing Sequence

2-2. ALGORITHM FOR CALCULATING ALLOWABLE NMCS AIRCRAFT. To meet flying hour and availability goals, the maximum number of aircraft allowed to be down due to a lack of parts (allowable NMCS aircraft) is determined for each day. As shown in Figure 2-2, separate minimums are computed for aircraft required to meet the flying objective and those required to meet the availability objective (if any). The larger of the two minimums is subtracted from the number of surviving aircraft on each day to yield the "allowable NMCS aircraft" for that day. Within the subsequent processing algorithms, the "allowable NMCS aircraft" is converted to an "allowable stockout" for each part and replacement policy. The "allowable stockout" for a part on a day is just the maximum number of backorders (unfilled demands) for the part which will still allow accomplishment of the case objective (flying hour and availability) on that day, i.e., these are parts that are missing but which do not have to be bought.

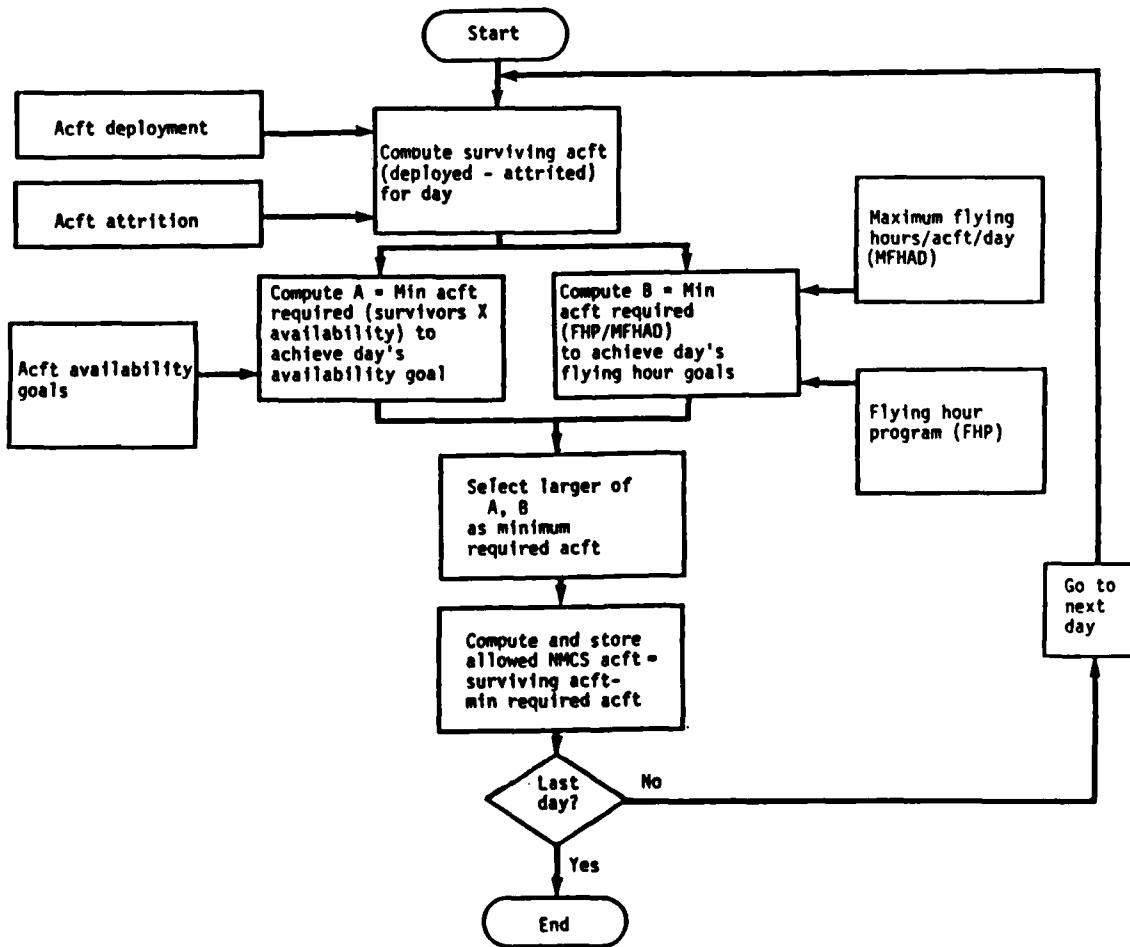


Figure 2-2. Extended PARCOM Computation Algorithm for Allowable NMCS Aircraft

2-3. UNCONSTRAINED COST REQUIREMENTS ALGORITHM IN BASIC PARCOM. Extended PARCOM uses the requirements algorithm of basic PARCOM as a step in its unconstrained cost calculation. Therefore, the logic of that predecessor program is detailed below. Recall that basic PARCOM only processed a full-substitution replacement policy and a no-substitution replacement policy. (The "NMCS = 0" policy is just a special case of no substitution.) The calculation of allowable NMCS aircraft (described previously) is the same for both versions of PARCOM.

a. Unconstrained Cost Full-Substitution Requirement. Figure 2-3 shows the basic PARCOM algorithm used to compute a requirements solution for three parts replacement policies with unconstrained costs. The difference between full-substitution and no-substitution calculations is in the way that allowed stockouts are calculated. Net demand is the same for each.

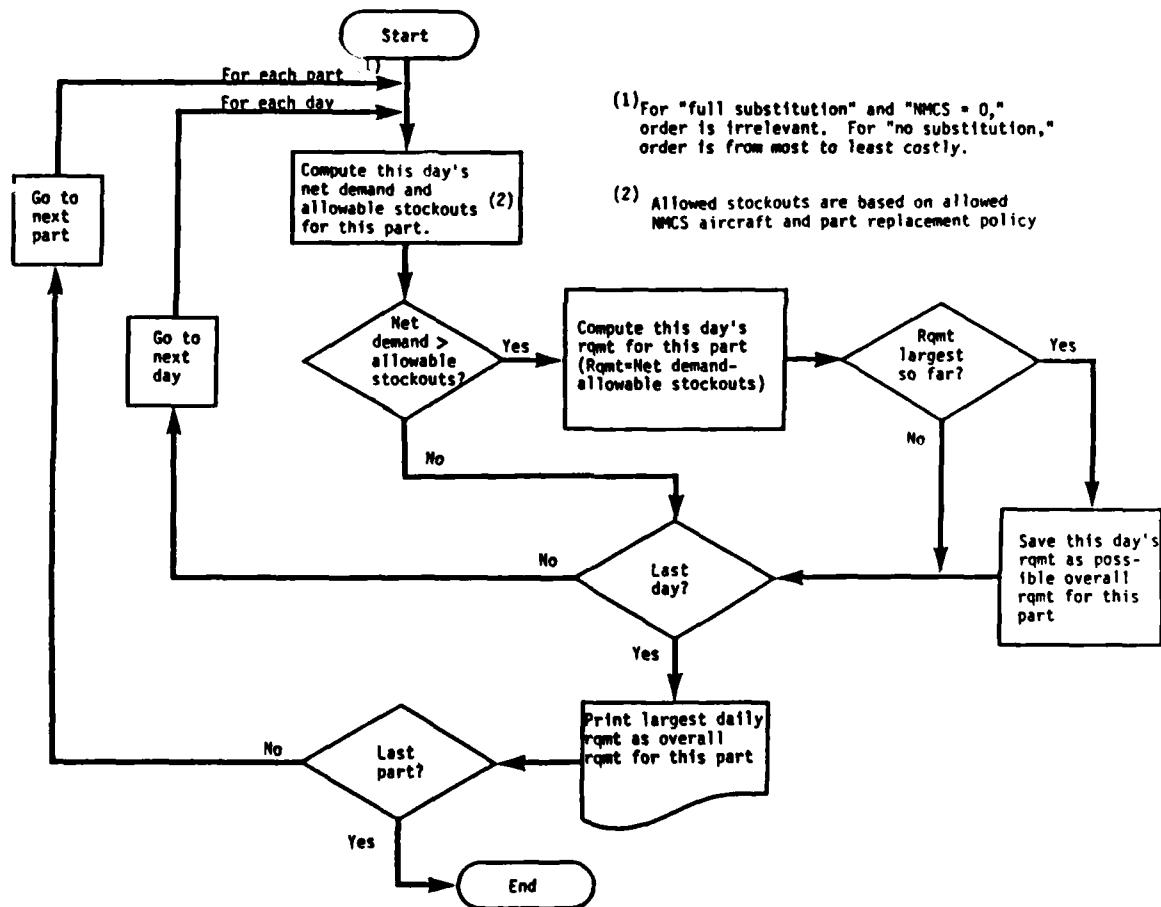


Figure 2-3. Basic PARCOM Requirements Computation Algorithm for Unconstrained Costs, "Full Substitution," "No Substitution," and "NMCS = 0"

(1) Net demand (for all three replacement policies) for a part at any point in time is the cumulative removals through that time minus the sum of cumulative returning repairs and issued inventory. Removals are generated as the product of failure rate, part QPA (quantity installed per aircraft), and programmed fleet flying hours. Returning repairs are generated by having removed parts cycled through a "repair pipeline" and being returned to the theater spare pool. A positive net demand represents a shortage of a part.

(2) Under full substitution, the aircraft frames providing the sources of parts substituted for failed parts when spares unavailable are consolidated to the minimum possible number, i.e., there will be a maximum overlap of aircraft frames providing missing parts. Because of this overlap, the spare parts requirements for each part may be independently computed. For a full-substitution policy, the allowable stockout for a part on any day is the product of allowable NMCS aircraft for that day and the part QPA.

(3) As indicated by Figure 2-3, the minimum spare requirement for a part needed to achieve the case objective on any day is the net demand for that part minus the allowable stockout. The overall spare requirement for a part is the largest of the daily minimum spare requirements for that part. It is a least-cost solution because it is the smallest purchase of that part which will permit the case objective to be met on all days.

b. Unconstrained Cost "NMCS = 0" Requirement. The "NMCS = 0" policy corresponds to the case in which 100 percent aircraft availability is required every day. In such a case, allowed NMCS aircraft and allowable stockout both must be zero every day. The "NMCS = 0" case could be considered a special case of full substitution with a 100 percent aircraft availability objective (the no-substitution case with that objective would yield the same answer, because substitution policy is irrelevant when no stockouts are allowed). The spares required by the solution to the "NMCS = 0" case also can be interpreted as the total expected net demand for a part during the war. It is a least-cost solution because any amount less than that required to meet the expected demand will create an NMCS aircraft, i.e., will not meet the case objective.

c. Unconstrained Cost No-Substitution Requirement

(1) Under no substitution, the stockouts generated by parts removals in excess of on-hand spares must each be associated with separate aircraft frames. Every missing part results in an inoperable (NMCS) aircraft. It is most cost effective, therefore, to assign the allowed stockout (allowed number of NMCS aircraft) to the most expensive parts. For example, if 50 aircraft are allowed to be NMCS and a shortage exists of 50 expensive parts and 50 cheap ones, the 50 cheap ones need to be bought. If 75 expensive parts and 50 cheap ones are short, there will be no choice but to buy 25 expensive ones (leaving 50 unbought) and 50 cheap ones, in order to best meet the case objective.

(2) The algorithm of Figure 2-3 also applies to the no-substitution and "NMCS = 0" requirements. Under no substitution, an allowed stockout equates to an allowed NMCS aircraft; and the total allowed stockout, over all parts, equals the total allowed NMCS aircraft for that day. However, allowed stockout calculations for individual parts are interdependent, i.e., the calculations for the first part affect those of the second, etc. The interdependence occurs because there is no overlap/consolidation of stockout effects (as was the case for full substitution). During the no-substitution calculations, basic PARCOM determines allowed stockout and net demand in decreasing order of part unit cost, i.e., for the most expensive parts first. The aspects of algorithm operation affected by differences in substitution policy are summarized in Table 2-1.

Table 2-1. Differences in Application of Basic PARCOM Unconstrained Cost Requirements Algorithm by Policy

Policy	Algorithm procedure/calculation	
	Allowable stockout	Order of processing
Full-sub	Allowed NMCS acft x QPA	Irrelevant
No-sub	Allowed NMCS acft	By decreasing part cost
NMCS = 0	0	Irrelevant

2-4. UNCONSTRAINED COST REQUIREMENTS ALGORITHM IN EXTENDED PARCOM

a. Partial-substitution Concept Definition. Prior to describing the requirements calculation algorithms, it is important to describe the specific representation of a partial-substitution replacement policy in Extended PARCOM. A partial-substitution parts replacement policy is defined by a user-specified partitioning of all part types into a full-sub set and a no-sub set. A part type is in only one set and remains in that set throughout the scenario. These sets are defined as follows:

(1) All parts in the full-sub set operate with a full-substitution replacement policy relative to aircraft which are NMCS due to lack of a part from that set. That is, a failed full-sub part on an aircraft may be replaced either by a spare (if available) or by a serviceable part installed on an NMCS aircraft which is awaiting a full-sub part, if a spare is not available. However, no failed full-sub part can be replaced by any part installed on an NMCS aircraft awaiting a no-sub part.

(2) Parts in the no-sub set operate with a no-substitution replacement policy. That is, a failed no-sub part on an aircraft may only be replaced by a spare part. An NMCS aircraft lacking a no-sub part may neither receive a serviceable part from another NMCS aircraft, nor may it provide a serviceable part to (fill a "hole") in any other NMCS aircraft.

b. **Selection of Full-sub Parts.** Before requirements processing begins in Extended PARCOM, a full-sub and a no-sub part set, applicable over all scenario days, must be defined. One option allows the user to specify those part types which comprise the full-sub set. By default, all non-specified parts are presumed to be in the no-sub set. However, the model has another option, allowing the user to specify four screening limits--L1, L2, L3, and L4. With these limits, the model selects a part type for the full-sub set if at least one of the following apply:

- The (input) depot repair cycle time for the part exceeds L1 days, and the not repairable this station (NRTS) fraction exceeds zero.
- The (input) NRTS fraction for the part exceeds L2.
- The (input) retail repair time for the part exceeds L3.
- The (input) failure rate for the part exceeds L4.

c. **Partial-substitution Algorithm Logic.** Figure 2-4 shows the sequence of processing in Extended PARCOM for unconstrained cost requirements. The sequence of operations is:

- (1) Partition all part types into a full-sub set and a no-sub set as defined in paragraph 2-4a.
- (2) Calculate the allowable NMCS aircraft for each day.
- (3) For each day:
 - (a) Generate all possible nonnegative integer combinations (AF, AN) (for full-sub and no-sub, respectively) such that $AF + AN = \text{allowable NMCS aircraft for that day}$.
 - (b) For each integer combination (AF, AN), compute a basic PARCOM full-sub solution **over only the full-sub part set** for the scenario through that day, assuming AF allowed NMCS aircraft (awaiting full-sub parts) for that day. Also compute a basic PARCOM no-sub solution **over only the no-sub part set** for the scenario through that day, assuming AN allowed NMCS aircraft (awaiting no-sub parts) for that day. Calculate the total solution cost for the combination (AF, AN) as the sum of the costs for the full-sub and no-sub solutions described above.

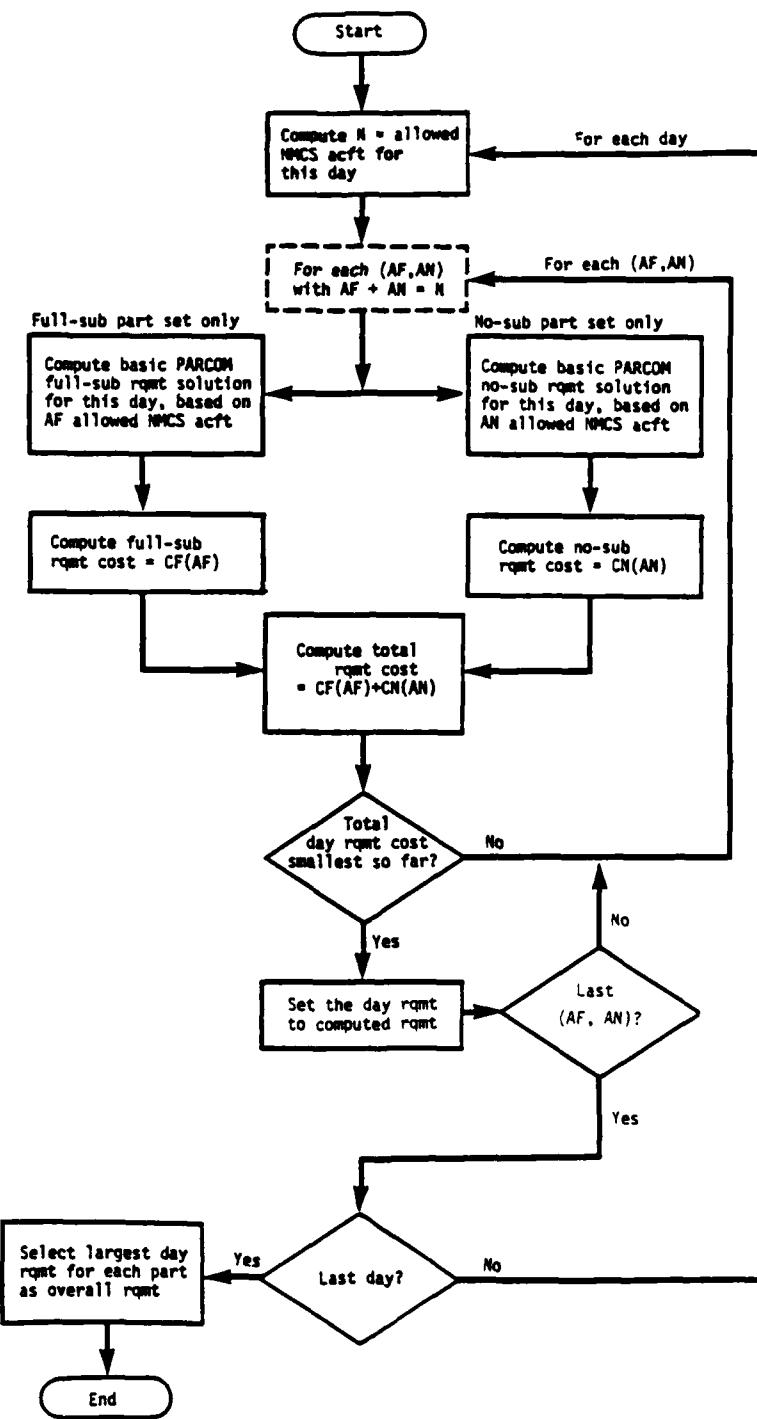


Figure 2-4. Extended PARCOM Requirements Computation Algorithm for Unconstrained Cost, Partial Substitution

(c) Select the solution for the combination (AF, AN) yielding the **minimum** total solution cost. This solution determines the requirements for each part on that day and is called the day requirement. The combination (AF, AN) used in the selected solution then becomes the allowed stockout used during cumulative (from Day 1) calculations on all succeeding scenario days.

(4) After all days are processed, select the largest (over all scenario days) of the computed day requirements for each part as the overall requirement. The logic for computing a basic PARCOM solution is described in paragraph 2-3. The above algorithm tends toward a least-cost solution mix (assuming unconstrained funds) for the partial-substitution replacement policy defined by the full-sub/no-sub partition of the part data base.

2-5. CONSTRAINED COST REQUIREMENTS ALGORITHM IN BASIC PARCOM. While the unconstrained cost solution is the one that best meets the flying program, a full requirements buy may not be affordable if funds are limited. With constrained costs, a user wishes to apply limited funds to buy a cost-effective slice of the full requirements. Basic PARCOM only treated the constrained cost case for a no-substitution policy. Neither full substitution nor partial substitution were addressed. Extended PARCOM incorporates a method for deriving cost-effective constrained cost requirements under partial substitution. For a no-substitution policy, the Extended PARCOM constrained cost algorithm yields the same solution as the basic PARCOM constrained cost algorithm. Since the Extended PARCOM algorithm uses the constrained cost algorithm of basic PARCOM at one stage of its computation, foundation logic from that predecessor model is presented first. In basic PARCOM after the unconstrained cost no-substitution requirements are computed, they become the basis for the constrained cost solution. A cost limit on spares is input along with the other scenario and objective data. A constrained cost parts mix can be constructed by the simulated purchase, in order of increasing part unit cost, of the part requirements for the unconstrained cost solution until the available funds are exhausted. That would entail the procurement, within the fund limit, of the largest possible number of affordable parts from the unconstrained cost solution. However, another characteristic of such a constrained cost parts mix is that it is the mix which has the fewest unbought (hence, unstocked) items from the unconstrained cost solution. The basic PARCOM algorithm, shown in Figure 2-5, arrives at its solution by calculating unbought items. Initially, it "spends" the full cost of the unconstrained cost requirements mix, assuming it to be the constrained cost solution. Basic PARCOM subsequently selects the fewest number of items to remove from that solution until the remaining parts mix is priced at the input cost limit. Because the programmed algorithm solves by "unbuying" items rather than "buying" them, parts are processed in decreasing order of part unit cost. Notice that under a policy of no substitution, each unbought item (regardless of part type) creates an NMCS aircraft. Therefore, our constrained cost solution mix minimizes the instances of NMCS created by the constrained funds. The solution tends, heuristically, toward the achievement of maximum cumulative flying hours.

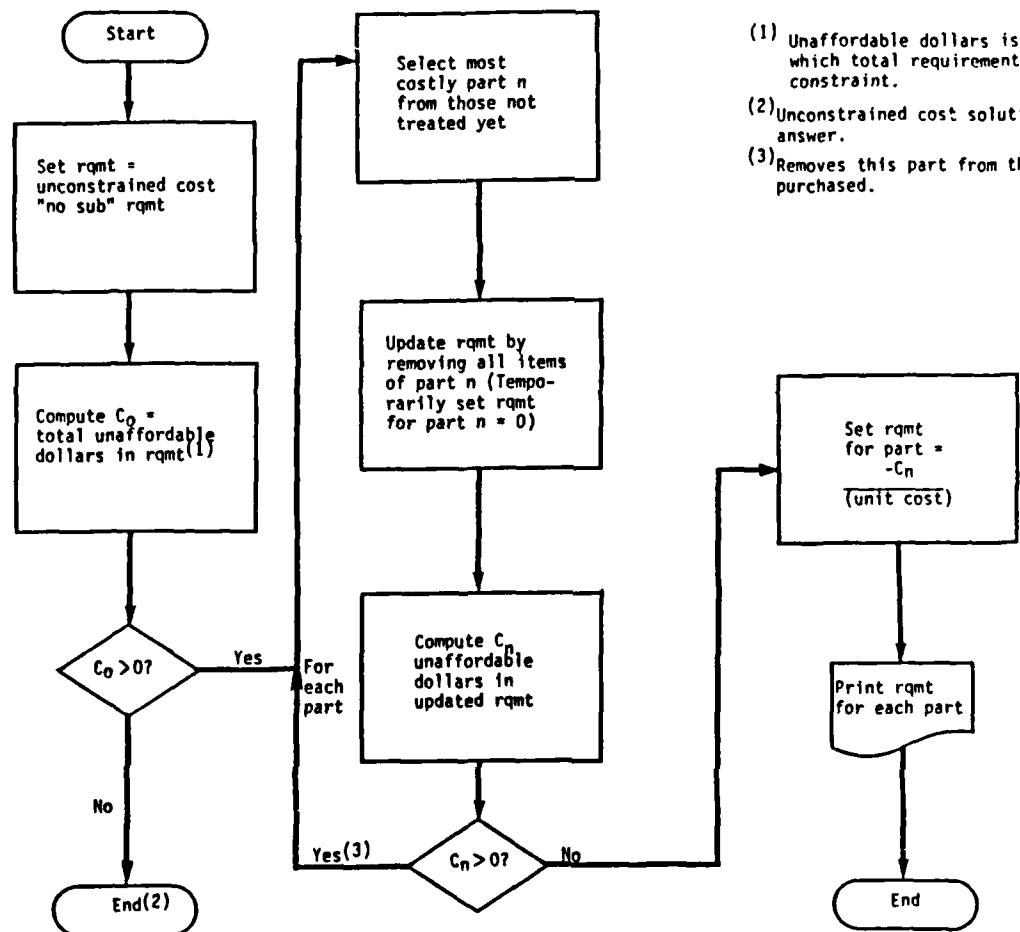


Figure 2-5. Basic PARCOM Requirements Computation Algorithm for Constrained Cost with No Substitution

2-6. CONSTRAINED COST REQUIREMENTS ALGORITHMS IN EXTENDED PARCOM. Figure 2-6 shows the logic for constrained cost calculations in Extended PARCOM. Since no single algorithm yielding optimum results for all cases was found, the Extended PARCOM logic employs two separate algorithms represented by the branches labeled "algorithm 1" and "algorithm 2" in the figure. These algorithms compute separate trial solutions. Each computed solution is assessed in terms of the fleet program flying hour productivity which it contributes. The trial solution yielding the larger flying hour productivity is selected as the final solution. The component algorithms of Figure 2-6 are explained below.

a. Constrained Cost Algorithm 1 Solution. The previously computed unconstrained cost requirements solution is partitioned into the set of requirements for no-sub parts and the set of requirements for full-sub parts. In Figure 2-6, these are denoted as "no-sub part set only" and "full-sub part set only." The "no-sub part set only" is taken as the unconstrained cost no-sub requirement which the basic PARCOM no-substitution constrained cost algorithm (Figure 2-5) operates on, using the input-specified cost limit (LIM in Figure 2-6), to yield a cost effective solution mix of no-sub parts. From this procedure, there are two possible outcomes: either the entire cost limit is spent, or only a portion of the cost limit is spent. Each outcome yields a different algorithm 1 solution as follows:

- (1) In the first outcome, the basic PARCOM solution mix cost, C , equals the cost limit. That mix of no-sub parts is then taken as the algorithm 1 solution.
- (2) In the second case, the cost of the basic PARCOM solution mix will be less than the cost limit. That solution mix is then assumed bought, and its associated cost, C , is assumed spent. The unspent portion, $FLIM$, of the cost limit is then calculated. Computation of the algorithm 1 solution then continues by using the $FLIM$ dollars to buy the most cost-effective portion of the "full-sub part set only," as follows:
 - (a) One product of the Extended PARCOM unconstrained cost solution is a list showing, for each day, the cumulative total cost of all full-sub parts in the unconstrained cost requirement for the scenario truncated at that day. Algorithm 1 determines D , the last day for which the associated cumulative requirement cost of full-sub parts is less than or equal to the unspent funds, $FLIM$.
 - (b) Next, algorithm 1 generates an Extended PARCOM unconstrained cost solution for the scenario truncated at that day. The full-sub parts required in that solution are denoted in Figure 2-6 as the "constrained cost requirements solution for full substitution." These full-sub parts are combined with the no-sub solution mix previously bought to form the full algorithm 1 solution for the second case.

b. Constrained Cost Algorithm 2 Solution. Figure 2-7 shows the logic of algorithm 2. One product of the Extended PARCOM unconstrained cost solution is a list showing, for each scenario day, the cumulative cost of all parts (full-sub and no-sub) that would be required under unconstrained cost if the war was truncated at that day. The algorithm determines D , the last day on that list, for which the associated cost is less than or equal to the input cost limit. Next, the algorithm operates Extended PARCOM in the unconstrained cost mode for a scenario of length D . The resulting (unconstrained cost) solution is taken as the algorithm 2 solution.

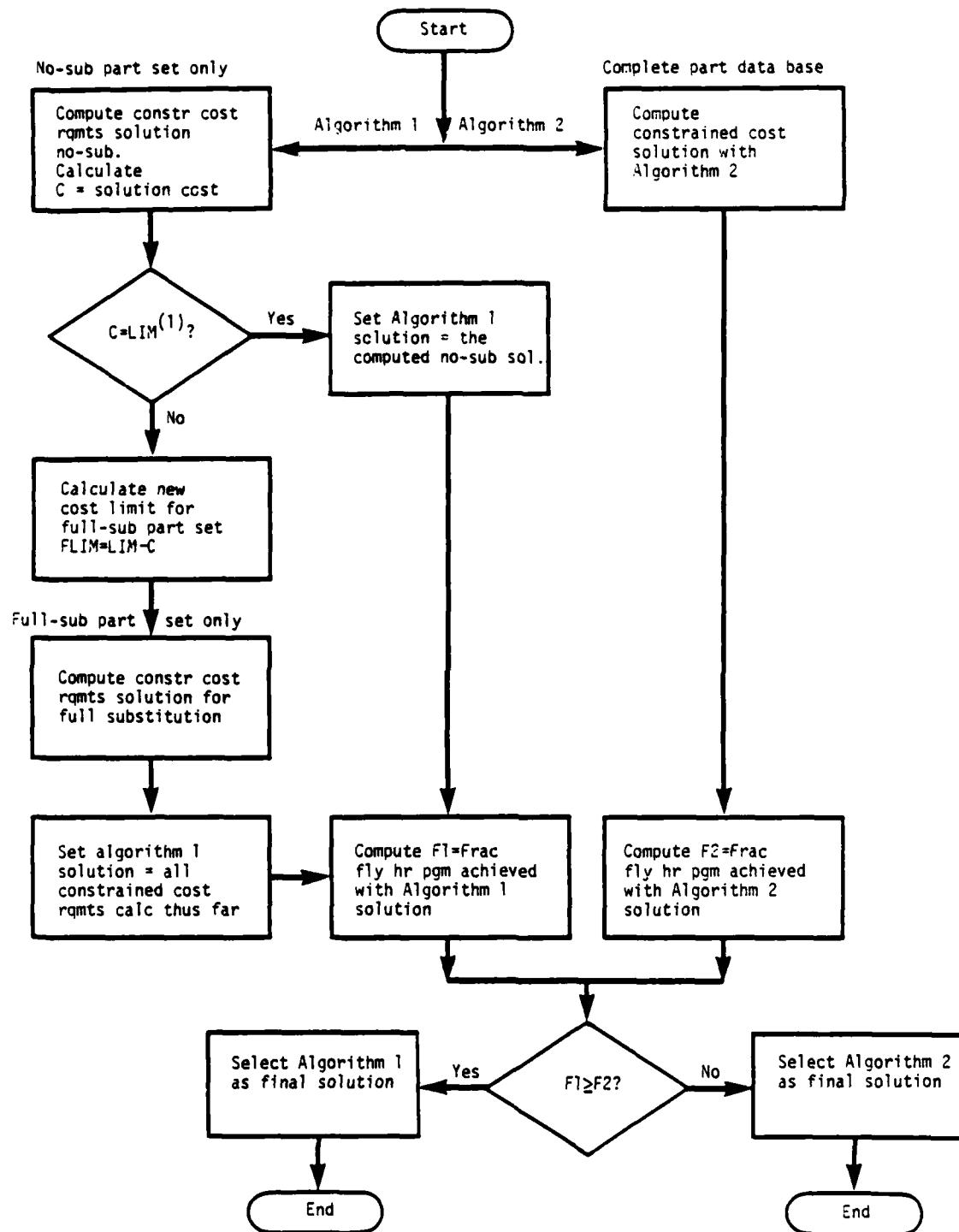


Figure 2-6. Extended PARCOM Requirements Computation Algorithm for Constrained Cost with Partial Substitution

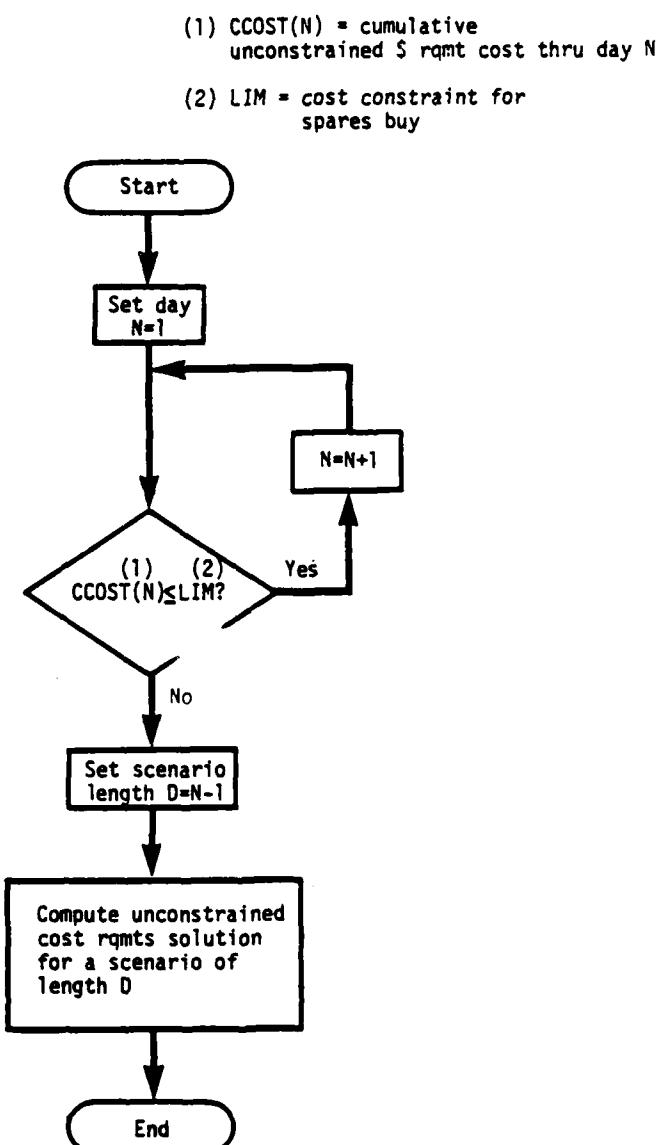


Figure 2-7. Extended PARCOM Constrained Cost Algorithm 2

c. Solution Selection. The preferred solution mix, of those generated by the two algorithms, is the one which yields the maximum program flying hour productivity in the scenario. The model, therefore, does two separate current inventory capability assessments based on each algorithm solution being bought and stocked. The add-on solution requirement is assumed to be added to the theater war reserve. The final constrained cost solution is the one for which the associated capability assessment yields the larger value for average fraction of total flying hour program achieved (F1 or F2 in Figure 2-6).

2-7. CAPABILITY ASSESSMENT OF UNCONSTRAINED COST SOLUTIONS. Figure 2-8 illustrates the Extended PARCOM computation algorithm for capability assessment of the unconstrained cost requirements solutions. After an unconstrained cost solution mix is computed, Extended PARCOM generates a record of daily and average fleet operational capability achievable by stocking each computed requirement in the war reserve, i.e., the new initial inventory is assumed to be the sum of the computed requirement and the original initial inventory. For each computed unconstrained cost requirements mix, the model generates a record of achieved daily and average aircraft availability and achieved flying hours per available aircraft per day. The achieved program flying hours are simply the desired program flying hours, by the definition of an unconstrained cost solution. Within the algorithm, each day's calculations consist of a full-sub assessment phase and a no-sub assessment phase, followed by a consolidated computation. Each full-sub phase treats only NMCS aircraft created by stockouts of full-sub parts. For a full-substitution policy, a single NMCS aircraft may have demands for several different parts. In this case, the total number of NMCS aircraft created is the largest value, over all full-sub parts, of the quotient of net demand divided by QPA for each full-sub part type. The no-sub phase treats only NMCS aircraft created by stockouts of no-sub parts. For a no-substitution policy, each net demand creates a single NMCS aircraft. In this case, the total number of NMCS aircraft created is the sum of net demand over all no-sub parts. At the end of daily processing, the consolidated total NMCS aircraft for the day is calculated as the sum of the NMCS aircraft results from the two phases. Under our definition of partial substitution, each NMCS aircraft is down due to either at least one needed full-sub part or to a single needed no-sub part, but not to a needed combination of the two types. Therefore, the order of performing the phases is irrelevant. For each day, the number of NMCS aircraft is subtracted from the number of surviving aircraft to yield available aircraft. Availability is then the ratio of available to surviving aircraft. Flying hours per available aircraft is just the daily program flying hours divided by the number of available aircraft for the day.

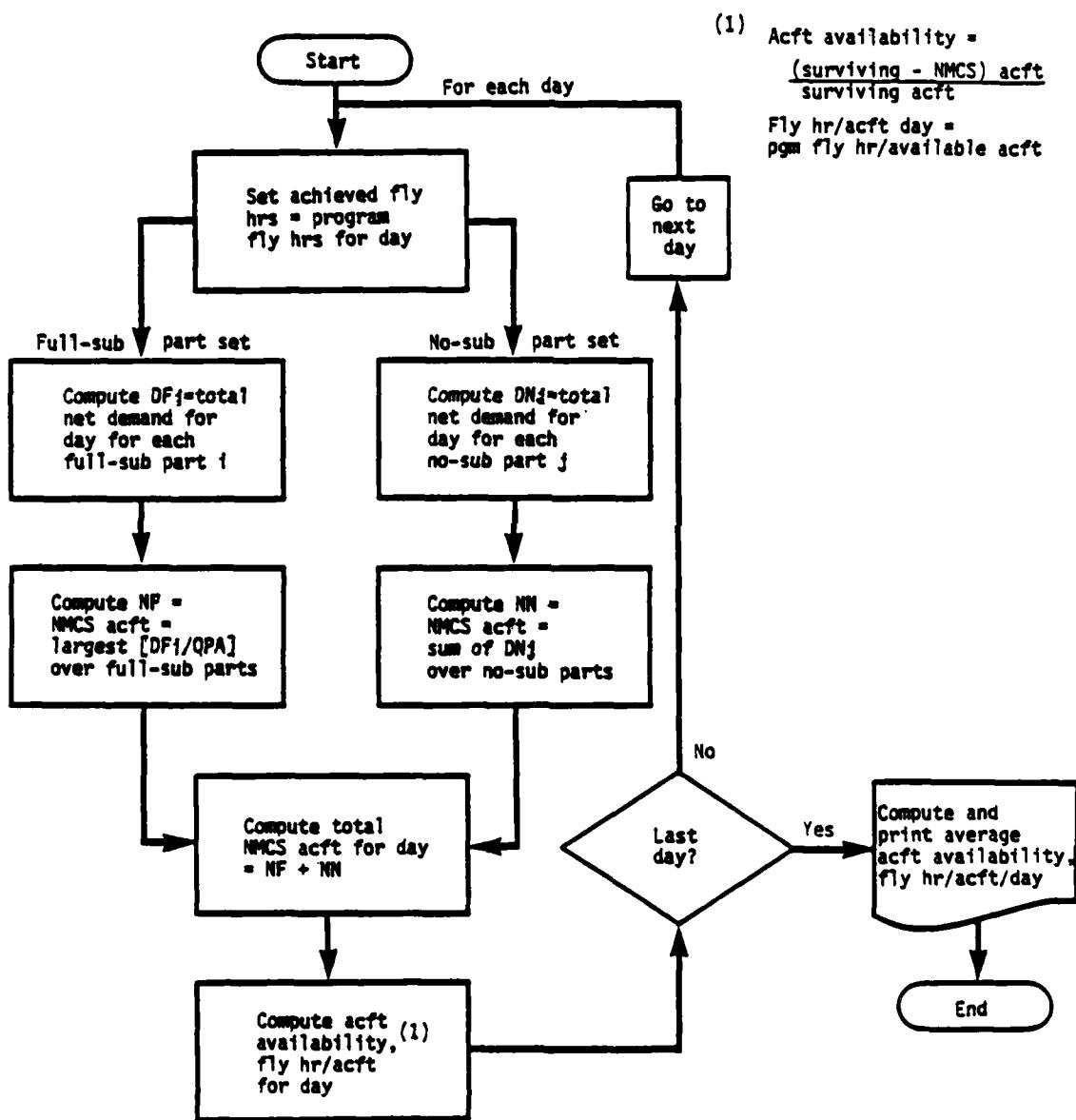


Figure 2-8. Extended PARCOM Computation Algorithm for Unconstrained Cost Capability Assessment

2-8. CAPABILITY ASSESSMENT OF CONSTRAINED COST SOLUTION MIXES. Extended PARCOM also generates the daily fleet availability and flying hour capability achieved with a constrained cost solution mix or with current inventory. Computation logic is shown in Figure 2-9. By current inventory is meant any user-specified inventory (with an add-on cost constraint of zero). This is in contrast to the "required inventory" as assessed above. The basic logic of assessment of current inventory in Extended PARCOM is the same as in the basic PARCOM. With unconstrained cost, net demand was based on the entire planned flying hour program being flown. For a constrained cost or current inventory mix, some unknown (at first) number of hours will be flown. That number must initially be estimated; and an iterative approach, as shown in Figure 2-9, applied to determine NMCS aircraft, availability, and achievable program flying hours. For each day, therefore, a starting estimate of flying hours flown is made. The starting (first day's) estimate is the desired program flying hours. Then, net demand, as based on the estimated flying hours, is computed, followed by computation of implied NMCS aircraft (generated by the estimated flying hours), achievable flying hours (based on aircraft available if implied NMCS aircraft are really NMCS), and flying hours per available aircraft. The achievable flying hours are compared with the estimated flying hours flown. If, based on input thresholds, they are close enough, the iterations stop. Iterations also stop after an input-specified number of them have been performed. If iterations continue, the calculations are repeated based on a new starting estimate of flying hours equal to the average of the estimated and the achieved flying hours. After iterations for a day are completed, the available aircraft for the day and their flying hour potential are calculated based on the last calculation of NMCS aircraft and on the maximum flying hour potential per aircraft per day (an input). Processing for the next day uses a starting estimate of flying hours equal to the program flying hours for that day or the flying hour potential of the surviving non-NMCS aircraft on that day, whichever is smaller.

2-9. EXAMPLE. The algorithm logic described in the previous paragraphs can be better understood through use of a manual example. The tables to follow portray a stylized but useful hypothetical example which utilizes only "back-of-the envelope" calculations. The tables all apply to one case and are presented in the same sequence as the model algorithms described in the previous paragraph.

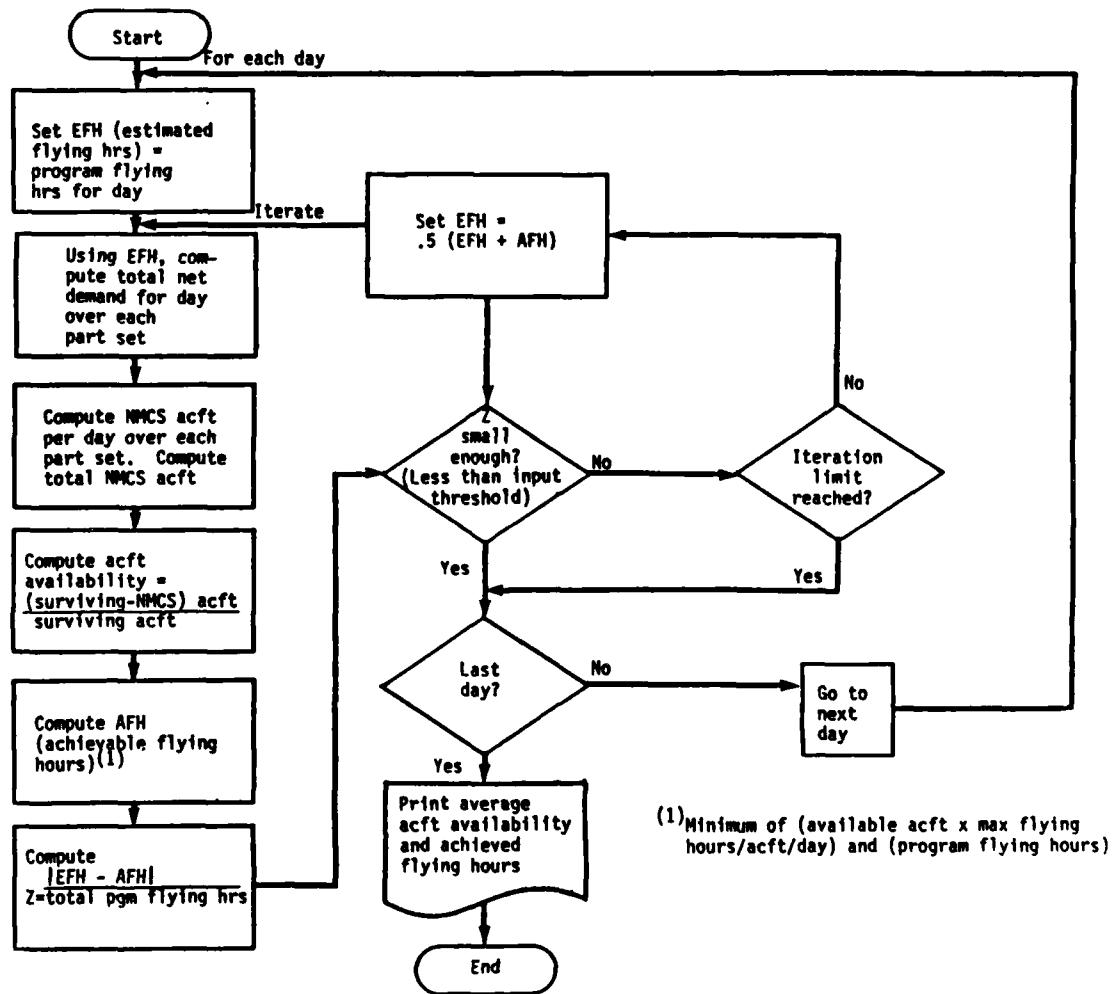


Figure 2-9. Extended PARCOM Computation Algorithm for Constrained Cost/Current Inventory Capability Assessment

a. **Parts Data Base.** Tables 2-2 through 2-4 show a parts data base for four part types. Recall that failure rate is in terms of failures per flying hour, and QPA = number of parts installed per operational aircraft. The last column of Table 2-4 is the computed repair cycle calculated from the other data in that row; e.g., for Part 1 the repair cycle = 2 x OST + depot repair time = 3 days. The repair cycle for a part is defined as the average time between failure of a part and its (repaired) return to the retail spare pool. Only the repair cycle entry will be used in succeeding calculations because it includes the effects of the other data in Table 2-4.

Table 2-2. Part Characteristic Data

Part	Failure rate (per fly hour)	QPA	Unit cost (\$)	Substitution class
1	.08	1	40	Full-sub
2	.02	1	50	Full-sub
3	.06	1	400	No-sub
4	.02	1	30	No-sub

Table 2-3. Initial Stock Distribution Data

Part	In-place Day 1	Addition to initial stock					Total initial stock
		Day 2	Day 3	Day 4	Day 5		
1	90	40	40	40	40		250
2	6	1	1	1	1		10
3	220	10	10	10	10		260
4	30	0	0	0	0		30

Table 2-4. Part Repair Time Data

Part	OST (days)	Depot repair time (days)	Retail repair time (days)	NRTS (fraction)	Depot condemned (fraction)	Retail condemned (fraction)	Repair cycle (days)
1	1	1	0	1.00	0	0	3
2	0	0	3	.00	0	0	3
3	1	2	0	1.00	0	0	4
4	0	0	2	.00	0	0	2

b. Definition of Policy. As noted in Table 2-2, Part 1 and Part 2 are designated for the full-sub set while Part 3 and Part 4 comprise the no-sub part set.

c. Scenario Data Base. Table 2-5 shows the scenario data for the case. A 5-day "war" is shown. The aircraft status (deployed, lost) entries are for the start of the associated day of the war. Thus, for example, 50 aircraft are newly deployed at the start of day 2. By "cumulative aircraft deployed" is meant all aircraft deployed in theater from the start of the war through the given day. No aircraft are assumed withdrawn once deployed. Computed "cumulative aircraft surviving" entries are defined by the difference between "cumulative aircraft deployed" and "cumulative aircraft lost." Since, for simplicity, our example shows a zero aircraft attrition rate, surviving aircraft are equal to deployed aircraft. The "program flying hours" column gives the flying hour objective in terms of required program flying hours for the fleet on each day. The last column gives the availability objective in terms of an input-specified daily minimum (fleet) aircraft availability required each day. The input-specified "maximum flying hours per aircraft per day" is also noted at the bottom of Table 2-5.

Table 2-5. Scenario Data

Day	Cumulative aircraft deployed	Cumulative aircraft lost	Cumulative aircraft surviving	Program flying hours	Minimum aircraft availability
1	150	0	150	500	.10
2	200	0	200	1,000	.09
3	200	0	200	1,000	.09
4	200	0	200	1,500	.09
5	200	0	200	1,500	.09

Maximum flying hours per aircraft per day = 10.

Cost limit for constrained cost case = \$2,300.

Desired convergence (constrained cost) = 0.

Maximum iterations (constrained cost) = 2.

d. Calculation of Daily Allowable NMCS Aircraft. Table 2-6 shows results of the calculation of allowable NMCS aircraft for each day. Each result in the rightmost column is the surviving aircraft minus the larger of:

(1) The minimum aircraft required to achieve the daily flying hour objective, for each day, computed as "program flying hours" divided by "maximum flying hours per aircraft per day."

(2) The minimum aircraft required to achieve the daily availability objective, for each day, computed as the product of "surviving aircraft" and "minimum aircraft availability." Component calculations for the first day, using the data of Table 2-5, are shown.

Table 2-6. Calculation of Allowable NMCS Aircraft

Day	Minimum aircraft required		Allowable NMCS acft
	Flying hour objective	Availability objective	
1	500/10 = 50	150*.10 = 15	150-50 = 100
2	100	18	100
3	100	18	100
4	150	18	50
5	150	18	50

e. Unconstrained Cost Residual Requirement. The full set of algorithmic calculations is too complex to represent. The Extended PARCOM algorithm consists of calculation and cost comparison of a large number of basic PARCOM full-substitution and no-substitution solutions using the full-sub and the no-sub part sets, respectively. However, two of these solutions for one value of AF and the consequent values of AN (see Figure 2-4) which serve as the base of the Extended PARCOM solution are illustrated below.

(1) The full-sub solution with zero allowed stockouts ($AF = 0$) is illustrated in Tables 2-7 and 2-8 for those parts in the full-sub set. Each "cumulative net demand" entry is just the "cumulative failures" minus the sum of the "cumulative returning repairs" and the cumulative initial stock distributed (from Table 2-3). "Cumulative failures" is based on the program hours being flown and is computed by accumulating (over days) the product of failure rate, QPA, and program flying hours for each day (as taken from Tables 2-2 and 2-5). The "cumulative returning repairs" entries are the "cumulative failures" entries lagged by 3 days (the repair cycle from Table 2-4). Any condemnations (our case has none) would have to be deducted from the lagged failures. If R is the length of the repair cycle for a part (see Table 2-4), Extended PARCOM treats all noncondemned failures occurring by the start of day n as being returned to the retail spare pool at the start of day $n + R$. If a part has both a depot repair cycle and a retail repair cycle, Extended PARCOM would partition repairs over the two cycles. In our simplified example, Part 1 has only a depot repair cycle of 3 days while Part 2 has only a retail repair cycle of 3 days. The "day requirement" is calculated as the larger of zero and (cumulative net demand minus allowable stockouts). Since this case has a zero allowed stockout, the day requirement is equal to the cumulative net demand. The overall requirement for each part is determined as the largest value (over days) of the "day requirement" entries. It is circled in each table. Component calculations are based on the data of Tables 2-2 through 2-6 and are shown for the first day and, partly, for the last day. Because allowed stockouts = 0 for this case, the solution shown is also an "NMCS = 0" solution in basic PARCOM.

Table 2-7. Unconstrained Cost Residual Requirement with Full-Substitution, Allowed Stockouts = 0 (Part 1)

Day	Cumulative failures	Cumulative returning repairs	Cumulative initial stk distributed	Cumulative net demand (= day rqmt)
1	.08*500=40	0	90	max (0,40-90) = 0
2	120	0	130	0
3	200	0	170	30
4	320	40	210	70
5	440	120	250	440-370 = <u>70</u>

Table 2-8. Unconstrained Cost Residual Requirement with Full Substitution, Allowed Stockouts = 0 (Part 2)

Day	Cumulative failures	Cumulative returning repairs	Cumulative initial stk distributed	Cumulative net demand (= day rqmt)
1	.02*500=10	0	6	max (0, 10-6) = 4
2	10	0	7	23
3	50	0	8	42
4	80	10	9	61
5	110	30	10	110-40 = 70

(2) The no-sub solution from basic PARCOM is shown in Tables 2-9 and 2-10 for those parts in the no-sub set. The tables are presented in the required sequence of computations, i.e., the more expensive no-sub part (Part 3) is processed first. The "cumulative net demand" is computed in the same way as for Part 1 and Part 2 above. The day requirement is just the cumulative net demand (the shortage on that day) minus the allowable stockout (the allowed shortage) for that day (but not less than zero). Under no substitution, daily allowed stockout is equal to daily allowable NMCS aircraft (computed in Table 2-6). The overall Part 3 requirement is the circled largest day requirement. The Part 3 requirement is treated as "purchased" during further processing (for other no-sub part requirements). Table 2-10 shows the calculation of the next no-sub part requirement which must be for the next most expensive no-sub part (i.e., Part 4 in our example). The purchase of the Part 3 requirement augments the initial inventory for that part. Therefore, the old cumulative net demand for Part 3 in Table 2-9 is reduced by the purchased requirement for that part to generate the new cumulative net demand for that part. Since the computed requirement was zero, the new cumulative net demand for Part 3 equals the old cumulative net demand in this example. The new cumulative net demand for Part 3 is also the number of stockouts which **must** be allocated to that part. For a no-substitution policy, the total allowed stockout consists of the summed stockouts over all parts treated. For each day, the cumulative net demand for Part 3 acts as a "lock" or "claimant" on the same number of stockouts in the original allowable stockout. Requirements for Part 4 can only be based on the unallocated allowable stockout, tabulated in Table 2-10, which is the original allowed stockout minus all "claimant" stockouts (net demands) from parts already processed (from Part 3 in this example). Since the Part 4 requirement is not yet "purchased" (it is being computed), the cumulative net demand entries for Part 4 in Table 2-10 are computed in the same manner as in Tables 2-7 and 2-8, using the initial stock distribution of Table 2-3. The day requirement in Table 2-10 is calculated as the cumulative net demand for Part 4 minus the unallocated allowable stockout.

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As before, the overall requirement (circled) is the largest of the day requirements. The Part 4 requirement would be assumed purchased, and the process would be continued with less expensive no-sub parts (if any). Each successive calculation would use an unallocated allowable stockout equal to the original allowable stockout reduced by the sum total of allocated stockouts reflected in purchases of parts already processed.

Table 2-9. Unconstrained Cost Residual Requirement with No Substitution (Part 3)

Day	Cum failures	Cum return repairs	Cum init stock	Cum net demand	Allowed stockout	Day rqmt
1	30	0	220	0	100	0
2	90	0	230	0	100	0
3	150	0	240	0	100	0
4	240	0	250	0	50	0
5	330	30	260	40	50	0

Table 2-10. Unconstrained Cost Residual Requirement with No Substitution (Part 4)

Day	Part 3 (new cum net demand)	Cumulative net demand (Part 4)	Unallocated allowable stockouts	Day rqmt
1	0	0	100-0 = 100	0
2	0	0	100-0 = 100	0
3	0	10	100-0 = 100	0
4	0	20	50-0 = 50	0
5	40-0 = 40	30	50-40 = 10	30-10 = 20

(3) After the above solutions are computed, they become the basis for the partial-substitution algorithm calculations for Day 5 shown in Table 2-11. The following comments apply:

(a) To simplify computations, the only combinations (AF, AN) shown are multiples of 10. Since, from Table 2-6, total allowed NMCS aircraft on Day 5 from all parts must equal 50, the sum of AF and AN in Table 2-11 must be 50.

(b) For AF = 0 on Day 5, the solution for the full-sub part set is 70 for Part 1 and 70 for Part 2 (Tables 2-7 and 2-8, respectively). These are also the requirements for these parts under an "NMCS = 0" policy in basic PARCOM.

(c) For values of AF greater than 0, solutions for the full-sub parts set are obtained by subtracting $AF \times QPA$ ($= AF$ since $QPA = 1$ in this example) units from each part requirement in the "AF = 0" solution (since each reduction of parts stock by its QPA units creates QPA backorders which, in turn, correspond to one NMCS aircraft).

(d) The no-sub solution for AN (allowed NMCS aircraft for the no-sub set) = 50 on Day 5 is computed in Tables 2-9 and 2-10. For AN less than 50, a no-sub solution is obtained, as seen in Table 2-11, by adding $(50 - AN)$ units to the computed stock requirement for the cheapest item(s) in the "AN = 50" solution in the following manner. Units are added first to the computed requirement for the cheapest part, up to the level of cumulative net demand for that part, after which further units are added to the computed requirement for the next cheapest part, in the same manner. Using this technique, each increase of one unit eliminates a backorder and corresponds to one less NMCS aircraft.

(e) The minimum combined (total) solution cost (\$6,300) is marked in Table 2-11. The combined parts requirement for the associated (AF, AN) combination is the day requirement for Day 5. If (as assumed in this example) Day 5 has the largest day requirement, then that day requirement is also the overall minimum cost solution for our partial-substitution example.

Table 2-11. Unconstrained Cost Residual Requirement Calculations for Day 5

Combined solution	AF	Full-sub solution pt 1/pt 2 \$40/\$50	Cost (\$)	AN	No-sub solution pt 3/pt 4 \$400/\$30	Cost (\$)	Combined solution cost (\$)
1	0	70/70	6,300	50	0/20	600	6,900
2	10	60/60	5,400	40	0/30	900	6,300
3	20	50/50	4,500	40	10/30	4,900	9,400
4	30	40/40	3,600	20	20/30	8,900	12,500
5	40	30/30	2,700	10	30/30	12,900	15,600
6	50	20/20	1,800	0	40/30	16,900	18,700

Minimum cost solution = Pt 1 Pt 2 Pt 3 Pt 4

60 60 0 30
(assuming Day 5 has max day requirement).

f. Capability Assessment of the Unconstrained Cost Solution. Tables 2-12a and b shows the Extended PARCOM capability assessment calculation of the effects of stocking the requirements computed in Table 2-11. Each day's calculations entail a full-sub assessment phase and a no-sub assessment phase, operating on the full-sub part set (Parts 1 and 2) and the no-sub part set (Parts 3 and 4), respectively. During the full-sub phase, NMCS aircraft from failed full-sub parts is determined as the larger of the (cumulative net demand/QPA) entries over Parts 1 and 2, where cumulative net demand is based on initial inventory as augmented by the computed requirement from Table 2-11. Therefore, the entries for Parts 1 and 2 consist of the cumulative net demand entries from Tables 2-7 and 2-8 reduced by the value of the computed requirements. During the no-sub phase, NMCS aircraft from failed no-sub parts are determined as the sum of the cumulative net demand entries for Parts 3 and 4, where cumulative net demand is based on initial inventory as augmented by the computed requirements. Under the assumed definition of partial substitution, each NMCS aircraft is "down" due to either at least one needed full-sub part or a single needed no-sub part, but not to a needed combination of the two types. Therefore, the order of performing the phases is irrelevant. On each day, after the two NMCS aircraft calculation phases are completed, the

sum of the two results yields the total NMCS aircraft for the day (Table 2-12b). This value divided by surviving aircraft on that day determines the fraction NMCS. Subtracting this fraction NMCS from 1.00 yields aircraft availability for the day. Flying hours per (available) aircraft per day are calculated by dividing the program flying hours for each day (see Table 2-5) by the number of available aircraft on that day. Average availability is constructed by weighting daily availabilities by the daily surviving aircraft. Average flying hours per (available) aircraft per day are weighted by the available aircraft on each day.

Table 2-12a. Capability Assessment for Unconstrained Cost Residual Requirements^a

Day	Phase ^b	Cum net demand/QPA Part 1	Cum net demand/QPA Part 2	Cum net demand Part 3	Cum net demand Part 4	NMCS aircraft
1	FS	0	0	--	--	0
	NS	--	--	0	0	0
2	FS	0	0	--	--	0
	NS	--	--	0	0	0
3	FS	0	0	--	--	0
	NS	--	--	0	0	0
4	FS	70-60=10	61-60=1	--	--	10
	NS	--	--	0	0	0
5	FS	70-60=10	0	--	--	10
	NS	--	--	40	0	40

^aResidual requirement (60,60,0,30) is added to initial war reserve stock.

^bFS = Full-sub phase (processes full-sub part set)
NS = No-sub phase (processes no-sub part set)

Table 2-12b. Capability Assessment for Unconstrained Cost Residual Requirement

Day	Total NMCS aircraft	Surviving aircraft	Aircraft availability	Program flying hours/acft/day
1	0	150	1.00	3.3
2	0	200	1.00	5.0
3	0	200	1.00	5.0
4	10+0=10	200	190/200=.95	7.9
5	10+40=50	200	.75	10.0

Average availability = .94

Average flying hours/aircraft/day = 6.2

g. Capability Assessment of Current Inventory/Constrained Cost Case. Since the same algorithm applies to capability assessment of current inventory and of a constrained cost solution, only assessment of current inventory will be detailed here. Tables 2-13a, b, and c show the calculations for this case. As before, calculation of daily NMCS aircraft is done in two phases. Now, however, each phase of each day employs a series of iterative calculations, as explained in paragraph 2-8, beginning with an "estimated flying hours flown" and, based on that estimate, calculating an "achieved flying hours" value. Iterations continue until estimated and achieved flying hours are close together or until a specified number of iterations have been performed. Some essential explanatory comments follow the tables.

Table 2-13a. Capability Assessment of Current Inventory

Day	Iteration	Phase	Est fly hrs	Cum net dmd/QPA Part 1	Cum net dmd/QPA Part 2	Cum net demand Part 3	Cum net demand Part 4	NMCS acft
1	1	FS	500	0	4	--	--	4
	1	NS	500	--	--	0	0	0
2	1	FS	1,000	0	23	--	--	23
	1	NS	1,000	0	--	0	0	0
3	1	FS	1,000	0	42	--	--	42
	1	NS	1,000	--	--	0	10	10
4	1	FS	1,500	70	61	--	--	70
	1	NS	1,500	--	--	0	20	20
	2	FS	1,300	54	57	--	--	57
	2	NS	1,300	--	--	0	16	16
5	1	FS	1,270	36	61	--	--	61
	1	NS	1,270	--	--	14	21	35
	2	FS	1,165	27	59	--	--	59
	2	NS	1,165	--	--	8	19	27

Table 2-13b. Capability Assessment of Current Inventory

Day	Iteration	Total NMCS aircraft	Avail aircraft	Achieved flying hrs	(EFH-AFH)/(average day FHP) ^a
1	1	4	146	500	0
2	1	23	177	1,000	0
3	1	52	148	1,000	0
4	1	90	110	1,100	.36
	2	73	127	1,270	.03
5	1	96	104	1,040	.21
	2	86	114	1,140	.02

^aAverage flying hour program (FHP) = 1,100 flying hrs/day.

Table 2-13c. Capability Assessment of Current Inventory

Day	Surviving ^a aircraft	Aircraft avail	Fraction flying program achieved	Program flying hrs/acft/day
1	150	.97	1.00	3.4
2	200	.88	1.00	5.6
3	200	.74	1.00	6.8
4	200	.63	.85	10.0
5	200	.57	.76	10.0

^aFrom the scenario data (Table 2-5).

(1) Estimated flying hours on the first iteration of each day are equal to the daily program hours (Table 2-5) or the flying hour potential of surviving non-NMCS aircraft, whichever is smaller. Surviving non-NMCS aircraft are the difference between cumulative aircraft surviving (Table 2-5) and the total NMCS aircraft computed on the last iteration of the preceding page. The associated flying hour potential is the product of this difference and the maximum flying hours/aircraft/day from Table 2-5.

(2) The cumulative net demand entries in Table 2-13a are calculated based on the estimated flying hours of each day and iteration. Thus, as long as estimated flying hours equal the flying program these values are identical to the cumulative net demand entries of Tables 2-7 through 2-10 (which are based on the program hours). This applies through Day 3 in the example. Entries for subsequent days can be determined by subtracting (failure rate x cumulative flying hour deficit) from the appropriate entry in Tables 2-7 through 2-10. For example, on iteration 2 of Day 4, the estimate is 1,300 program hours, representing a deficit of 200 hours from the daily program. Thus, the associated cumulative net demand entry for Part 1 is $200 \times .08 = 16$ less than the cumulative demand entry (70) of Table 2-7. Similarly, the Part 2 entry is $200 \times .02 = 4$ less than the Day 4 net demand entry (61) of Table 2-8. On Day 5, iteration 2, the cumulative flying hour deficit is the sum of the deficits from the last iterations for Days 4 and 5, viz $(1,500 - 1,300) + (1,500 - 1,165) = 535$ hours. The above adjustment technique is a short-cut which yields the same answer as direct calculation.

(3) The "NMCS aircraft" column of Table 2-13a is just the larger of the "cum net demand/QPA" values for the full-sub set and phase, and is the sum of the "cum net demand" entries for the no-sub set and phase.

(4) "Total NMCS aircraft" in Table 2-13b is just the sum of the NMCS aircraft from each phase.

(5) Available aircraft are computed as (surviving aircraft - total NMCS aircraft), where surviving aircraft is from the scenario data (Table 2-5).

(6) Achieved daily flying hours is just the smaller of (avail acft x 10) and the daily flying program. Recall that maximum flying hours/acft/day = 10.

(7) Program flying hours/acft/day is, from Table 2-13c, the quotient of the achieved flying hours and the available aircraft.

(8) The (EFH-AFH)/(avg daily FHP) column of Table 2-13b is a "closeness measure." EFH denotes estimated flying hours while AFH denotes achieved flying hours. Their difference is divided by the average program flying hours per day for the scenario. If this is small enough, iterations terminate. Since Table 2-5 specified "desired convergence = 0," estimated flying hours must equal achieved flying hours in order for iterations to terminate due to closeness. When EFH does not equal AFH, daily iterations continue up to the maximum iteration limit (2) specified in Table 2-5. If iterations continue, the average of estimated and achieved flying hours for this iteration becomes the estimated flying hours for the next iteration. Thus, $(1,500 + 1,100)/2 = 1,300$ hours is the estimated flying hours for iteration 2 of Day 4.

(9) Daily aircraft availability in Table 2-13c is calculated as the ratio of computed available aircraft (from the last daily iteration of the previous section of the table (2-13b) and surviving aircraft. Daily fraction flying program achieved is the achieved daily flying hours (from the last iteration) divided by the program hours.

h. Constrained Cost Residual Requirement Solution. Two algorithms are applied, and the better solution (in terms of flying hour productivity) is chosen. The starting base for each algorithm is the unconstrained cost solution (Table 2-11). From Table 2-5, the residual cost limit is \$2,300. The complete calculations for the example case are too complex to represent here; however, the following steps illustrate algorithm application:

(1) Algorithm 1 (para 2-6a) first applies the constrained cost algorithm of basic PARCOM (para 2-5) to the no-sub parts in the unconstrained cost solution using the input cost limit (\$2,300). Any money "left over" is applied to buy a cost-effective slice of the full-sub parts in the unconstrained cost solution. Since the cost limit exceeds the price of the no-sub part set in the example unconstrained cost solution ($\$900 = 0 \times 400 + 30 \times 30$), the basic PARCOM no-sub solution is the entire no-sub solution set, and \$1,400 is left over to buy full-sub parts. To obtain a cost-

effective slice from this, Table 2-14 is used. The "full-sub parts" column shows, for each day, the cost of the full-sub parts in the total unconstrained cost requirements solution for the scenario truncated at that day. Extended PARCOM internally operates with this table. Such a "dollar vs day" table shows the full-sub portion of total requirements cost through each day. From the table, the day with associated full-sub parts cost closest to (but no more than) the money left over (\$1,400) is Day 4, with a full-sub cost of \$1,350. Extended PARCOM then generates a standard unconstrained cost solution (as in Table 2-11) for the example with a 4-day scenario. The full-sub parts in that solution are extracted and merged with the no-sub parts found earlier. The resulting merged solution is shown in Table 2-15. Extended PARCOM then applies the capability assessment algorithm for current inventory/constrained cost to generate the fleet capability assessment resulting from adding the algorithm 1 solution to current inventory. The resulting average fraction flying program achieved (.947) is noted for later use.

(2) Algorithm 2 (Figure 2-7) is similar to the second phase of algorithm 1 except that it operates on all parts. Table 2-14 shows the residual requirement costs (all parts) through each day. Day 4 is the day for which the associated cost (\$1,950) is closest to (but does not exceed) the input cost limit (\$2,300). Extended PARCOM then generates a standard unconstrained cost solution for the example with a 4-day scenario. That solution (shown in Table 2-16) is the algorithm 2 solution. A capability assessment is again done, but with the algorithm 2 requirement added to current inventory. The resulting average fraction flying program achieved is .946 of the required program.

Table 2-14. Residual Requirement Costs Through Given Day

Day	Full-substitution parts (\$)	No-substitution parts (\$)	All parts (\$)
1	0	0	0
2	0	0	0
3	0	0	0
4	1,350	600	1,950
5	5,400	900	6,300

Table 2-15. Algorithm 1 Constrained Cost Solution

Full substitution		No substitution	
Part	Requirement	Part	Requirement
1	20	3	0
2	11	4	30

Table 2-16. Algorithm 2 Constrained Cost Solution

Full substitution		No substitution	
Part	Requirement	Part	Requirement
1	20	3	0
2	11	4	20

(3) The solution yielding the higher average fraction flying program achieved is then selected as the overall solution. For the example, the algorithm 1 solution is chosen as the final solution. The already-computed algorithm 1 capability assessment then applies.

(4) Note that the solutions generally only approximate the input cost limit. The approximation is necessary because the full-sub part requirements are determined by incrementing over whole (i.e., nonfractional) days of flying program sustainability. For very small problems, such as in the example, the approximation may be poor in dollar terms. However, the solution cost is usually closer to the cost limit in large problems. In all cases, the difference between the solution cost and the cost limit must be less than a single extra day of flying program sustainability.

CHAPTER 3

OPERATIONAL CONSIDERATIONS AND CAVEATS

3-1. CASE OBJECTIVES. The user can specify a flying hour objective in conjunction with an aircraft availability objective. For each of these, one of two subobjectives is selected. The associated case types are noted below.

a. Maximizing Cumulative Flying Hours Achieved. This flying hour objective is always operating when running a constrained cost case. It entails the direct determination of the parts mix which will yield the greatest number of achieved flying hours for a specified cost limit. The flying hours achieved will be less than the desired flying hour program if the cost limit is less than the cost of the unconstrained cost solution mix.

b. Maximizing Consecutive Daily Program Flying Hours Achieved. This flying hour objective is relevant only to constrained cost cases since, for unconstrained cost cases, achieved flying hours = program flying hours. Obtaining a solution with this objective is a two-stage process. First, the user runs Extended PARCOM in an unconstrained cost mode for the full wartime period. The output list from that run shows, for each day, the cumulative cost of the add-on parts that would have been required if the war had been truncated at that day. D, the last day on that list for which the associated cost is less than or equal to the cost limit of the constrained cost case, is then the maximum number of consecutive days of 100 percent flying program sustainability with "cost limit" spares dollars. Next, to get the solution mix associated with D, Extended PARCOM is rerun, in the unconstrained cost mode, with a truncated war of D days length.

c. Minimum Specified Daily Aircraft Availability. This objective is in addition to any flying hour objective and is operative in all cases. The availability objective may increase the demand for available aircraft beyond those required to achieve the flying program. The input availability constraints are, as described previously, used to calculate daily allowed NMCS aircraft, which, in turn, are used in all case calculations.

d. No Specified Aircraft Availability. Extended PARCOM must always read in values for minimum daily aircraft availability objectives. However, entering blank or zero equates to not specifying an availability objective.

3-2. CAPABILITY ASSESSMENT. Normally, Extended PARCOM capability assessments are performed after add-on requirements are determined for both unconstrained and constrained cost cases. In the unconstrained cost cases, flying hour and availability goals are fully met, so the assessed achievements are simply the same as the goals. However, average availability over the course of the war, which cannot be input as a goal, is also determined. For constrained cost cases, days of sustainability, fraction of daily and total flying hour program achieved, and daily and average aircraft availabilities are determined. At times, however, it is also desirable to be able to assess the degree to which an aircraft fleet, with its current or some other starting inventory (and no add-ons), can meet specified flying or availability goals. This can be done in Extended PARCOM for a variety of user-specified partial-substitution replacement policies. An assessment under the policy specified for requirements cases is always generated. However, the user may define a number of other partial-substitution policies for which individual current inventory capability assessments are desired from a single model "run." The partial-substitution policies are specified in terms of the partition of the parts data base into full-sub and no-sub part sets.

3-3. IMPACT OF PARTS DISTRIBUTION OVER TIME. The distribution of parts over time, as opposed to front loading of stocks, has no effect on Extended PARCOM results if all initial assets reach retail before they are required (as replacements). An ideally efficient stockage and transportation system will achieve this. Parts distribution over time may effect an increase in requirements, relative to front loading, if initial assets are sufficiently delayed so that they do not arrive in retail before all retail stocks are drawn down. In effect, such delayed assets may have their usefulness negated because they are in the wrong place at the wrong time. Similarly, the effect of such delays on capability assessment of current inventory may be a decrease in the period over which the flying program can be continuously sustained.

3-4. CAVEATS AND LIMITATIONS. The principal caveats and limitations on use of the Extended PARCOM Model, as applied in the study, are discussed below. Program modification and/or restructuring is required to extend model capabilities beyond the cited limits.

a. Number of Part Types Processed. The Extended PARCOM Model version demonstrated at the US Army Concepts Analysis Agency (CAA) can process at most 300 different part types. Simple (but memory consuming) modifications to the structure of the program can significantly increase this capacity.

b. Restrictive Partial-Substitution Policy Definition. Extended PARCOM only treats one concept of partial substitution. Other concepts may not be adaptable to the model methodology. The deterministic (as opposed to stochastic) nature of the model limits the range of processes which can be "added on."

c. Only Two Centralized Supply Levels. Extended PARCOM shares the Overview Model "world view" of a retail level and a wholesale level. With full substitution, each level has full cross-leveling (lateral transferability) of parts.

d. No Indenture Levels. Part types in the Extended PARCOM (and Overview) data base are nonoverlapping modular units, i.e., no part is a subcomponent of another listed part type. Use of indentured data is not processable in Extended PARCOM.

e. No Direct Maintenance Modeling. As with Overview, Extended PARCOM treats maintenance only indirectly, by incorporation into the repair time or by using an aircraft deployment/attrition data base, which is adjusted for aircraft down ("lost") due to maintenance constraints. Such adjustments could be based on results of a separate high-resolution simulation model which previously processed a "slice" of the scenario.

f. No Stochastic Results. All Extended PARCOM results are "expected value." Neither input nor results have variable probabilistic aspects (e.g., confidence levels). Safety levels would have to be treated separately as an add-on to Extended PARCOM quantities. However, use of expected values is meaningful for comparisons and parametric evaluations. Methodology for incorporating stochastic considerations into Extended PARCOM would be complex. Conversion of the model into a stochastic simulation could entail high risk for an uncertain payoff.

CHAPTER 4
POTENTIAL PROGRAM MODIFICATION

4-1. MODULE FUNCTIONS. Figure 4-1 shows the main and subprogram modules of Extended PARCOM. The subprograms consist of seven subroutines and one function. A summary of operational purpose is given below for each module. Details of module operations can be read in the commented FORTRAN code for Extended PARCOM presented in Appendix A.

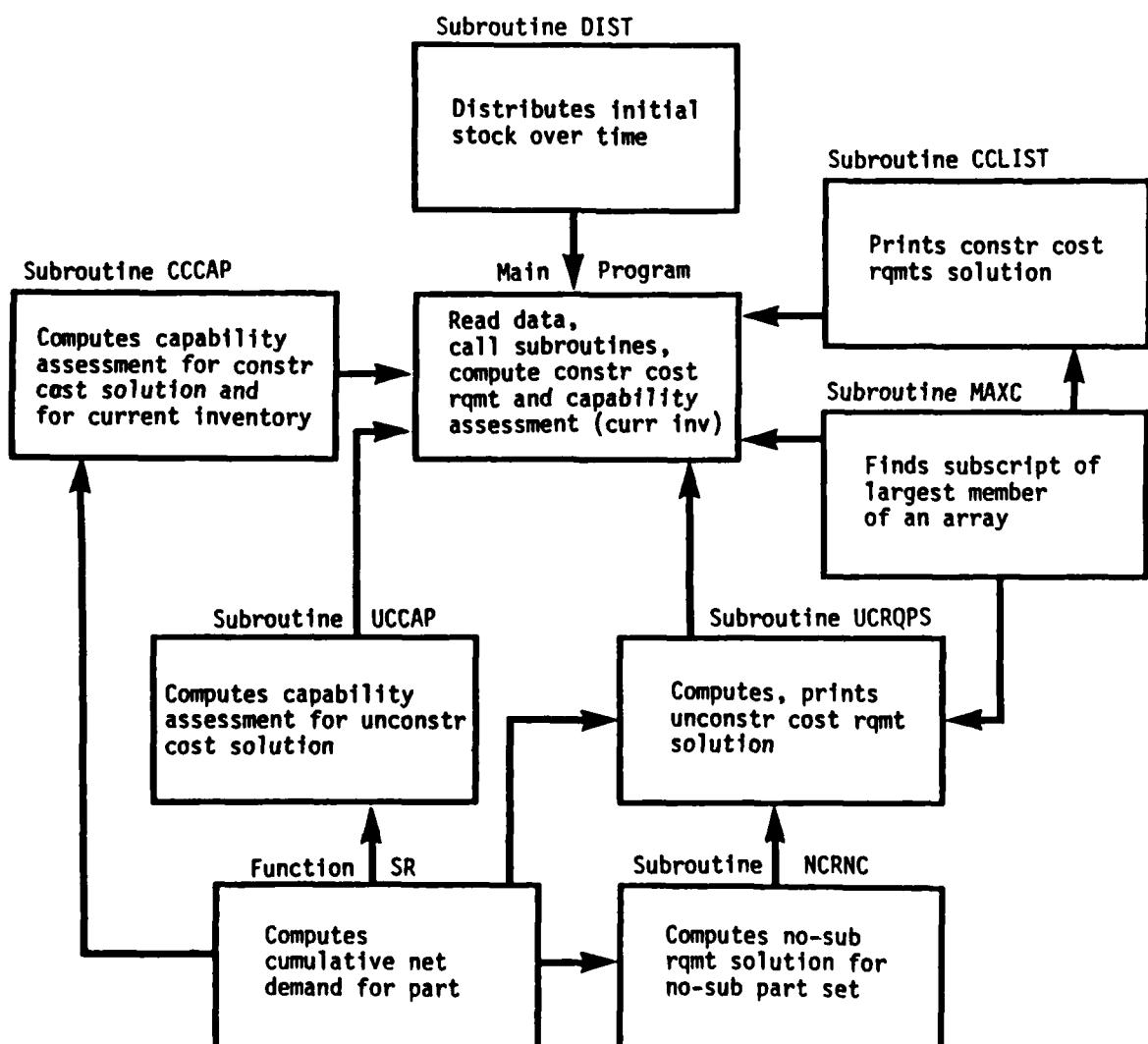


Figure 4-1. Extended PARCOM Subprogram Modules

a. Main Program. The Extended PARCOM main program:

- (1) Reads in all part and scenario data.
- (2) Prints summaries of the part and scenario data input.
- (3) Calls subroutine MAXC to order the part data base by part unit cost.
- (4) Calls subroutine DIST to distribute initial stock over time.
- (5) Calls subroutine UCRQPS to compute requirements and costs for the unconstrained cost case.
- (6) Calls subroutine UCCAP to compute capability assessment of the unconstrained cost solution mix.
- (7) Computes requirements and costs for the constrained cost case.
- (8) Calls subroutine CCLIST to print the constrained cost solution.
- (9) Calls subroutine CCCAP to compute capability assessment for the constrained cost solution.
- (10) Calls subroutine CCCAP to compute capability assessment of current inventory with various user-specified partial-substitution policies.

b. Subroutine UCRQPS. Subroutine UCRQPS is called only by the main program. It computes and prints the least-cost requirements mix of spare parts needed to achieve the case objective, given unconstrained funds. In addition to computing the unconstrained cost requirement, the subroutine operation is a part of the constrained cost requirements algorithm in the main program. Subroutine UCRQPS calls:

- (1) Subroutine NCRNC which computes unconstrained cost no-sub requirements solutions over only the no-sub part set. These solutions are used by the partial-substitution requirements algorithm.
- (2) Function SR which is used to compute cumulative net demand for each part.
- (3) Subroutine MAXC which is used to order computed requirements either in order of part unit cost or in order of amount of requirement.

c. Subroutine UCCAP. Subroutine UCCAP is called by the main program and calls function SR. It computes fleet capability (average availability, average program flying hours/aircraft/day) based on the unconstrained cost solution being stocked in the war reserve.

d. Subroutine CCCAP. Subroutine CCCAP is called by the main program and calls function SR. It computes fleet capability assessment based on the constrained cost solution being stocked in the war reserve. It is also called by the main program to compute capability assessments of current inventory for a series of user-specified partial-substitution policies.

e. Subroutine CCLIST. Subroutine CCLIST is called by the main program to print the constrained cost requirements solution. It calls subroutine MAXC for use in ordering the requirements list.

f. Subroutine DIST. Subroutine DIST is called by the main program and calls no external routines. It distributes the initial spares stock of a part type over a user-specified series of 5-day intervals.

g. Subroutine MAXC. Subroutine MAXC is called by the main program, by subroutine UCRQPS, and by subroutine CCLIST. It calls no external routines. This subroutine finds the largest member of a subscripted array. It is useful in rank-ordering a list according to the numeric value of a list attribute.

h. Subroutine NCRNC. Subroutine NCRNC is called by subroutine UCRQPS and calls function SR. It calculates a basic PARCOM unconstrained cost requirements solution for a no-substitution replacement policy. Its operation is an element of the Extended PARCOM partial-substitution requirements algorithm.

i. Function SR. Function SR is called by subroutine UCRQPS, by subroutine NCRNC, by subroutine UCCAP, and by subroutine CCCAP. No external routines are called. This function calculates the cumulative net demand through a specified day for a specified part based on a specified flying program. A zero initial inventory is assumed in this calculation.

4-2. ARRAY STORAGE. Definitions and sizes of Extended PARCOM array variables are given in the comments of the program code displayed in Appendix A. The types of arrays are local, as defined by DIMENSION statements, common, as defined by unlabeled COMMON, and character, as defined by CHARACTER declarations. Character variables occupy four words per entry in Extended PARCOM while other arrays require only one word per entry. During execution on the Sperry 1100/82 computer, Extended PARCOM occupies 47,000 words of memory.

4-3. EXTENSION OF DAY LIMIT. In the Extended PARCOM version delivered by CAA, 17 single-subscript arrays and 2 double-subscript arrays are defined in terms of the maximum number of days in the scenario. The current limit is 120 days. Those arrays of size 120 may be increased in size (through user reprogramming) to the scenario length desired insofar as computer memory permits. The arrays associated with the day limit, their dimensions, and the routines defining them are listed in Table 4-1.

Table 4-1. Extended PARCOM Arrays with a Day Limit Dimension

Array	Routine	Array	Routine	Array	Routine
AC(120)	COMMON	DCOST1(120)	COMMON	FHR(120)	COMMON
ALLOW1(120)	COMMON	DCOSTF(120)	COMMON	IFHC(120)	COMMON
ALLOWB(120)	COMMON	FHA(120)	COMMON	RNC(120)	COMMON
ALR(120)	Main	FHNC(120)	CCCAP	SM(120,100)	COMMON
ASURV(120)	COMMON	FHNZ(120)	CCCAP	SUMB(120)	COMMON
AVM(120)	COMMON	FHPAPD(3,120)	COMMON	SUMBZ(120) SUMP(120)	NCRNC NCRNC

4-4. EXTENSION OF TOTAL PARTS LIMIT. In the Extended PARCOM version delivered by CAA, 37 single-subscript arrays and 1 double-subscript array are defined in terms of the maximum number of parts to be processed. The current limit is 300 parts. Those arrays of size 300 may be increased in size (through user reprogramming) to any limit permitted by computer memory. The arrays associated with the parts limit and the routines defining them are shown in Table 4-2.

4-5. CAVEATS. If the day and/or parts limits are increased, the processing time required for Extended PARCOM requirements run execution increases by at least the product of the two limit multipliers, i.e., doubling the day limit and the part limit will at least quadruple processing time. The reader should note that capability assessments without requirements calculations (a user option) are much faster than executions with requirements calculations.

Table 4-2. Extended PARCOM Arrays with a Parts Limit Dimension

Array	Routine	Array	Routine	Array	Routine
ADESC(300)	COMMON	DCY(300)	COMMON	PTDEP(300,24)	COMMON
AMSN(300)	COMMON	DF(300)	COMMON	QPA(300)	COMMON
BC(300)	Main	DMD(300)	COMMON	RNCS(300)	COMMON
BCY(300)	COMMON	DMDT(300)	CCCAP	SRMAX1(300)	COMMON
BF(300)	COMMON	DOD(300)	COMMON	STK(300)	COMMON
CDMDA(300)	COMMON	DSER(300)	Main	TRNCS(300)	COMMON
CF(300)	COMMON	DUNSER(300)	Main	TSTK(300)	COMMON
CLASS(300)	Main	FR(300)	Main	RMIN(300)	UCRQPS
CNCS(300)	COMMON	IFS(300)	COMMON	WRES(300)	Main
COST(300)	COMMON	INS(300)	COMMON	WRESU(300)	Main
CRNCS(300)	COMMON	IRC(300)	COMMON	XRNCS(300)	Main
DAY1D(300)	Main	IRO(300)	COMMON	ZNRT(300)	Main
DC(300)	Main	OST(300)	Main		

APPENDIX A
EXTENDED PARCOM PROGRAM SOURCE CODE

MAIN PROGRAM	pages A-3 thru A-20
SUBROUTINE CCCAP	pages A-21 thru A-25
SUBROUTINE CCLIST	pages A-27 thru A-29
SUBROUTINE DIST	pages A-31 and A-32
SUBROUTINE MAXC	page A-33
SUBROUTINE NCRNCT	pages A-35 thru A-37
SUBROUTINE UCCAP	pages A-39 thru A-42
SUBROUTINE UCRQPS	pages A-43 thru A-48
FUNCTION SR	pages A-49 and A-50

CAA-D-85-3

(NOT USED)

MAIN PROGRAM

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1 C NAME: PARCOM-X      TYPE: MAIN PROGRAM
2 C WRITTEN BY: WALTER BAUMAN/AUTOVON -295-1662
3 C AT: US ARMY CAA/8120 WOODMONT AVE, BETHESDA, MD 20814
4 C
5 C PURPOSE: THE PARCOM-X (PARTS REQUIREMENTS AND COST MODEL-EXTENDED) IS USED
6 C TO GENERATE COST-EFFECTIVE MIXES OF SPARE PARTS REQUIRED TO ACHIEVE A
7 C FLYING PROGRAM/AVAILABILITY OBJECTIVE UNDER A USER-SPECIFIED
8 C -PART REPLACEMENT POLICY (EITHER FULL, PARTIAL OR NO SUBSTITUTION)
9 C -(PURCHASE) COST CONSTRAINT
10 C
11 C IN ADDITION, THE PROGRAM ALLOWS THE CAPABILITY ASSESSMENT OF AN AIRCRAFT
12 C FLEET BASED ON A USER-SPECIFIED SPARES INVENTORY APPLIED UNDER A
13 C VARIETY OF USER-SPECIFIED PARTS REPLACEMENT POLICIES
14 C
15 C ARGUMENTS: NOT APPLICABLE
16 C
17 C CALLED BY: NOT APPLICABLE
18 C
19 C CALLS
20 C   -SUBROUTINE MAXC: SELECTS LARGEST SUBSCRIPT OF AN ARRAY. USED TO
21 C   ORDER PART TYPES IN DECREASING ORDER OF UNIT COST.
22 C   -SUBROUTINE CCCAP: PERFORMS A FLEET CAPABILITY ASSESSMENT BASED ON
23 C   A SPARES STOCK EQUAL TO THE CONSTRAINED COST SOLUTION
24 C   AND/OR CURRENT INVENTORY
25 C   -SUBROUTINE CLIST: PRINTS SELECTED CONSTRAINED COST SOLUTIONS
26 C   -SUBROUTINE DST: DISTRIBUTES PARTS TO THEATER OVER 5-DAY INTERVALS
27 C   -SUBROUTINE UCOPS: COMPUTES A COST-EFFECTIVE REQUIREMENTS MIX BASED
28 C   ON THE UNCONSTRAINED COST SOLUTION BEING STOCKED
29 C   -SUBROUTINE UCCAP: COMPUTES FLEET CAPABILITY ASSESSMENT BASED
30 C   ON THE UNCONSTRAINED COST SOLUTION BEING STOCKED
31 C
32 C FILES USED : INPUT - UNIT 10 (PARTS DATA)
33 C                 - UNIT 11 (SCENARIO DATA)
34 C                 OUTPUT - UNIT 6 (PRINT)
35 C
36 C
37 C LOCAL ARRAYS
38 C
39 C
40 C   C NAME      DIMENSION  TYPE          DESCRIPTION
41 C   C ALR(I)      120  REAL        NR ACFT LOST(ATTRITION) ON DAY I
42 C   C AM(I)       61  REAL        AC AVAILABILITY CONSTRAINT FOR I-TH
43 C   C           'DAY INTERVAL', I.E. MINIMUM REQUIRED ACFT
44 C   C           AVAILABILITY IN I-TH 'DAY INTERVAL'
45 C   C AHSN(IJ)    300  CHAR        IDENTIFICATION NR(NSN) OF SPARE PART J
46 C   C BC(J)       300  REAL        BASE(RETAIL) CONDEMNATION RATE OF PART J
47 C   C           (I=FRACTION FAILURES 'JUNKED' AT RETAIL LEVEL)
48 C   C CLASS(IJ)   300  REAL        IDENTIFYING LABEL FOR PART SET WHICH PART J
49 C   C           BELONGS TO .(EITHER FULL-SUB OR NO-SUB)
50 C   C DAY1D(IJ)   300  REAL        AMOUNT OF ASL/PLL STOCK FOR PART J WHICH
51 C   C           IS IN-PLACE ON DAY I
52 C   C DC(J)       300  REAL        DEPOT CONDEMNATION RATE OF PART J
53 C   C           (FRACTION FAILURES 'JUNKED' AT DEPOT LEVEL)
54 C   C DSER(J)     300  REAL        AMOUNT OF SERVICEABLE INITIAL DEPOT STOCK
55 C   C           FOR PART J
56 C   C DUNSER(J)   300  REAL        AMOUNT OF UNSERVICEABLE INITIAL DEPOT STOCK
57 C   C           FOR PART J
58 C   C FRI(J)      300  REAL        FAILURE(=REPLACEMENT) RATE FOR PART J
59 C   C           EXPRESSED AS EXPECTED NR OF FAILURES
60 C   C           PER FLYING HOUR FLOWN.
61 C   C IDAY(I)     61  FIXED       ARRAY WHICH TEMPORARILY STORES INPUT DATA ON
62 C   C           DAYS BEGINNING 'DAY INTERVALS' (IDAY(I) TO
63 C   C           IDAY(I+1)) IN WHICH VARIOUS INPUT DATA
64 C   C           TAKE EFFECT
65 C   C NAC(I)      61  FIXED       NR OF AC DEPLOYED AT START OF I-TH TIME
66 C   C           INTERVAL (IDAY(I) TO IDAY(I+1))
67 C   C NFH(I)      61  FIXED       FLYING HR REQMT DURING I-TH TIME
68 C   C           INTERVAL (IDAY(I) TO IDAY(I+1))
69 C
70 C
71 C
72 C
73 C
74 C
75 C
76 C
77 C
78 C
79 C
80 C
81 C

```

82	C	OST(IJ)	300	REAL	ORDER/SHIP TIME (DAYS) FOR PART J (=INPUT-SPECIFIED OST + ADDOST)	
83	C	PT(K)	24	REAL	AMOUNT OF PART J DEPLOYED AFTER DAY I AND BETWEEN DAY 5*K-4 AND DAY 5*K	
84	C	JRES(IJ)	300	REAL	AMOUNT OF SERVICEABLE INITIAL WAR RESERVE FOR PART J	
85	C	URRES(IJ)	300	REAL	AMOUNT OF UNSERVICEABLE INITIAL WAR RESERVE FOR PART J	
86	C	XRNCSI(J)	300	REAL	ARRAY FOR TEMPORARILY STORING THE CONSTRAINED COST SOLUTION REQMT COMPUTED BY THE CONSTR COST ALGORITHM 1 FOR PART J.	
87	C	ZLOSS(IJ)	61	REAL	NUMBER OF DAILY AC LOSSES BY ATTRITION DURING I-TH TIME INTERVAL (IDAY(I) TO IDAY(I+1))	
88	C	ZNRT(IJ)	300	REAL	NRTS (NOT REPAIRABLE THIS STATION) FRACTION FOR PART J. THIS IS THE FRACTION OF FAILURES WHICH ARE SENT TO DEPOT FOR REPAIR.	
89	COMMON BLOCK (UNLABLED) ENTRIES					
90		NAME	DIMENSION	TYPE	DESCRIPTION	
91		AC(I)	120	REAL	NR ACFT DEPLOYED ON DAY I	
92		ACL	1	REAL	THE AMOUNT(S) OF SUSTAINABILITY DOLLARS, BASED ON THE "CUM REQMT COST THRU DAY N" TABLES, WHICH IS THE CLOSEST APPROXIMATION TO THE INPUT COST LIMIT FOR THE CONSTRAINED COST CASE	
93		ADESC(IJ)	300	CHAR	16 CHAR DESCRIPTION OF SPARE PART J	
94		ALLOWI(I)	120	REAL	THE "ALLOWABLE NMCS ACFT" FOR THE NO-SUB SET ON DAY I, COMPUTED AFTER DAY I IS PROCESSED. AFTER IT IS CALCULATED FOR DAY I, IT IS FIXED DURING ITERATIVE CALCULATIONS (INVOLVING DAY I) FOR NO-SUB REQMTS ON LATER DAYS.	
95		ALLOWB(I)	120	REAL	MAXIMUM ALLOWABLE NMCS AC ON DAY I WHICH WILL STILL ALLOW ACHIEVEMENT OF CASE OBJECTIVE (FLYING HOUR AND AVAILABILITY) ON DAY I	
96		AMSN(IJ)	300	CHAR	IDENTIFICATION NR(NSN) OF SPARE PART J	
97		ASURV(I)	120	REAL	NR AC SURVIVING (NOT ATTRITTED) ON DAY I	
98		AVAVGI(J)	6	REAL	AVAVG(1)=AVG ACFT AVAIL, FROM CAPABILITY ASSESSMENT, BASED ON STOCKAGE OF EITHER CURR INV OR (CURR INV + COMPUTED ADD-ON REQMTS SOLUTION) AVAVG(2)=AVG MIN ACFT REQ'D TO ACHIEVE THE FLYING HR/AVAILABILITY OBJECTIVE.	
99					AVAVG(3)=AVG FLY HR/AVAIL ACFT / DAY , FROM CAPABILITY ASSESSMENT, BASED ON EITHER CURR INV OR (CURR INV + THE SOLUTION REQMTS) BEING STOCKED.	
100		AVM(I)	120	REAL	AC AVAILABILITY CONSTRAINT (MIN REQUIRED NON-NMCS ACFT) FOR DAY I.	
101		BCY(IJ)	300	REAL	BASE(RETAIL) REPAIR TIME FOR PART J (INPUT)	
102		BF(IJ)	300	REAL	A COEFFICIENT USED IN THE CALCULATION OF NET DEMAND (SR(I,J,...,J)) FOR PART J. IT EQUALS (1-BC(IJ))*(1-ZNRT(IJ))*CF(IJ).	
103	C	CASE		CHAR	CASE ID	

165 C COMDA(IJ) 300 REAL ARRAY USED TO STORE THE CUMULATIVE NET DEMAND
 166 C (BASED ON INITIAL STK=0) FOR PART J ON THE
 167 C SCENARIO DAY BEING PROCESSED
 168 C
 169 C CF(IJ) 300 REAL A COEFFICIENT USED IN CALCULATION OF NET
 170 C DEMAND(SR(I,J,...)) FOR PART J. IT= =
 171 C FR(IJ)*OPA(IJ)
 172 C
 173 C CL 1 REAL THE COST LIMIT (AS SPECIFIED BY INPUT) USED
 174 C IN THE CONSTRAINED COST REQMTS CASE.
 175 C
 176 C CMINT 1 REAL TOTAL COST OF THE REQMT FOR THE UNCONSTRAINED
 177 C COST CASE
 178 C
 179 C CNCSI(J) 300 REAL TOTAL COST OF REQMT FOR PART J USING
 180 C THE SPECIFIED PART REPLACEMENT POLICY.
 181 C
 182 C COST(IJ) 300 REAL COST OF A SINGLE ITEM OF PART J. THIS IS
 183 C ALSO DENOTED AS "PART UNIT COST".
 184 C
 185 C CRNCSI(J) 300 REAL THE UNCONSTRAINED COST SOLUTION REQMT FOR
 186 C PART J AT ANY STAGE OF THE PARTIAL SUB
 187 C REQUIREMENT CALCULATION ALGORITHM.
 188 C
 189 C DCOSTI(I) 120 REAL THE TOTAL CUMULATIVE REQMTS COST THRU DAY I
 190 C FOR THE FULL SUB PARTS ONLY. I.E. THIS IS
 191 C THE PORTION OF THE "CUM REQMTS COST THRU DAY N"
 192 C ENTRY WHICH IS ASSOCIATED WITH THE FULL SUB
 193 C PART SET.
 194 C
 195 C DCOSTF(I) 120 REAL CUMULATIVE COST OF THE FULL REQUIREMENT
 196 C (ALL PARTS) THRU DAY I USING THE SPECIFIED
 197 C PART REPLACEMENT POLICY WITH UNCONSTRAINED
 198 C COST.
 199 C
 200 C DCY(IJ) 300 REAL DEPOT RECYCLE TIME FOR PART TYPE J. THIS IS
 201 C TIME BETWEEN REMOVAL AND RETURN FROM DEPOT
 202 C REPAIR. THIS = DEPOT REPAIR TIME + 2*ORDER
 203 C SHIP TIME.
 204 C
 205 C DF(IJ) 300 REAL A COEFFICIENT USED IN CALCULATION OF NET
 206 C DEMANDS(SR(I,J,...)) FOR PART J. IT= =
 207 C (1-DC(IJ))*ZNRT(IJ)*CF(IJ)
 208 C
 209 C DMD(IJ) 300 REAL WORKING VARIABLE USED IN CALCULATION OF
 210 C NET DEMANDS(SR(I,J,...)) FOR PART J ON DAY I
 211 C DURING CAPABILITY ASSESSMENT.
 212 C WHEN (CUM)NET DMD THRU DAY I IS BEING
 213 C CALCULATED, DMD(IJ) IS (CUM) NET DMD THRU THE
 214 C PREVIOUS DAY.
 215 C
 216 C DOD(IJ) 300 REAL ARRAY STORING THE ATTRIBUTE TO BE SORTED ON
 217 C IN SUBROUTINE MAXC. IN MAIN PGM, THIS HAS PART
 218 C UNIT COST FOR PART J. IN SUBROUTINES CCLIST &
 219 C UCROPS, THIS HAS THE AMOUNT OF THE SOLUTION
 220 C REQMT FOR PART J.
 221 C
 222 C FMA(I) 120 REAL DURING UNCONSTRAINED COST REQMT CALCULATIONS(ROUTINE
 223 C UCROPS) AND DURING UNCONSTRAINED COST CAPABILITY
 224 C ASSESSMENTS(ROUTINE UCAPCI) THIS IS THE FLEET
 225 C FLYING PROGRAM FLYING HOURS REQUIRED ON DAY I.
 226 C DURING THE CONSTRAINED COST CAPABILITY ASSESSMENT
 227 C (SUBROUTINE CCAPS) THIS IS THE INITIAL ESTIMATE
 228 C FOR FLYING HRS ACHIEVED ON DAY I WHEN
 229 C EITHER Curr Inv OR (Curr Inv + COMPUTED
 230 C CONSTRAINED COST ADD-ON REQMT) IS STOCKED.
 231 C DURING CAPABILITY ASSESSMENT THIS IS RECURSIVELY
 232 C COMPUTED
 233 C
 234 C FHM REAL MAXIMUM FLYING HRS PER ACFT PER DAY(INPUT)
 235 C
 236 C FHPAPD(M,I) 3,120 REAL FHPAPD(1,I)=FLYING HRS PER AVAILABLE ACFT PER
 237 C FOR DAY I UNDER THE SPECIFIED REPLACEMENT
 238 C POLICY BASED ON STOCKING (CURRENT INV +
 239 C THE UNCONSTRAINED COST SOLUTION)
 240 C
 241 C
 242 C
 243 C
 244 C
 245 C

		CURR INV + THE CONSTRAINED COST SOLUTIONS	
1	FHC(I)	12	REAL
2			DURING THE CONSTP COST CAPABILITY ASSESSMENT THIS IS FLEET PROGRAM FLYING HOURS REQUIRED ON DAY I ACCORDING TO THE INPUT FLYING HR PGM
3	FF(I,J)	3	REAL
4			FAILURE (REPLACEMENT) RATE FOR PART J EXPRESSED AS EXPECTED NR OF FAILURES PER FLYING HOUR FLOWN.
5	ICOST	1	FIXED
6			INDICATOR WHICH TELLS SUBROUTINE UCROPS WHETHER TO PRINT THE PARTS REQMTS LIST (I=0) IF NOT REQMTS LIST IS NOT PRINTED DURING CONSTRAINED COST REQMT CALCULATIONS.
7	IDCC(IND)	2	FIXED
8			STORES, FOR EITHER TOTAL (IND=1) OR RESIDUAL (IND=2), THE LATEST DAY FROM THE CUM COST REQMT THRU DAY N° TABLE (FROM THE UNCONST COST CASE) FOR WHICH ASSOCIATED CUM COST IS LESS THAN OR = THE INPUT-SPECIFIED COST LIMIT USED IN THE CONSTRAINED COST CASE.
9	IFHC(I)	12	FIXED
10			INDICATOR TELLING WHICH CONSTRAINT, FLY HR PGM (IFHC(I)=J) OR ACFT AVAILABILITY (IFHC(I)=1), DETERMINES REQUIRED DAILY FLEET AVAILABILITY FOR DAY I
11	IFS(I,J)	300	FIXED
12			ARRAY STORING THE PARCOM PART NUMBERS OF THE PARTS IN THE FULL-SUP PART SET.
13	INSEL		FIXED
14			NUMBER OF PART TYPES FOR WHICH INSTRV ITEM "CUMULATIVE (UNCONST COST) SOLUTION REQMTS THRU DAY N°" ARE DESIRED. (SEE SM(I,J) & IPT(J) BELOW)
15	INC(I,J)	300	FIXED
16			ARRAY STORING THE PARCOM PART NUMBERS OF THE PARTS IN THE NO-SUB PART SET.
17	INT	1	FIXED
18			THE INTERVAL AT WHICH THE PARTIAL SUB COMPUTATION ALGORITHM (ROUTINE UCROPS) INCREMENTS VALUES FOR "ALLOWABLE NMCS (CFT)" AT EACH STAGE OF CALCULATION OF SEPARATE REQMT SOLUTIONS FOR THE FULL-SUB SET AND THE NO-SUB SET. ALWAYS SET=1 FOR RELIABLE RESULTS. ITS VALUE IS SET =1 IN THE PROGRAM CODE.
19	IPT(J)	5	FIXED
20			ARRAY STORING INTERNAL PART NRS (SUBSCRIPTS) FOR PARTS FOR WHICH A CUMULATIVE DAY BY DAY REQUIREMENT HISTORY IS TO BE PRINTED
21	IQC(I,J)	3	REAL
22			ARRAY CONTAINING PART NUMBERS ORDERED ACC TO DECREASING PART UNIT COST FOR ASSOCIATED PART
23	IPU(I,J)	300	FIXED
24			ARRAY CONTAINING PART NUMBERS ORDERED ACC TO DECREASING SOLUTION REQMT AMOUNT FOR ASSOCIATED PART
25	NP	1	FIXED
26			NR OF PART TYPES PROCESSED IN RUN. (THIS EXCLUDES PART TYPES WITH ESSENTIALITY CODE "LF" I.ESS OR WITH A ZERO FAILURE RATE)
27	NP1	1	FIXED
28			TOTAL NUMBER OF "PART NUMBERS" IN THE FULL-SUB PART SET
29	NP2	1	FIXED
30			TOTAL NUMBER OF "PART NUMBERS" IN THE NO-SUB PART SET
31	NW	1	FIXED
32			LENGTH(DAYS) OF SCENARIO
33	PTLEP(J,K)	700,24	REAL
34			TOTAL AMOUNT OF INITIAL STOCK FOR PART J RECEIVED AT THEATER (EXCLUDING IN-PLACE STOCK) BETWEEN DAY 50K-4 AND DAY 50K
35	QPA(J)	3	REAL
36			THE "QUANTITY PER APPLICATION" FOR PART J. I.E. THE STANDARD NUMBER OF ITEMS OF PART J INSTALLED ON EACH OPERATIONAL ACFT
37	RNL(I,J)	12	REAL
38			AC AVAILABILITY IMPLIED BY STOCKAGE OF (COMPUTED REQMT + CURRENT INVENTORY) OR BY STOCKAGE OF ONLY THE CURRENT INVENTORY
39	INCS(I,J)	3	REAL
40			DRIVING REQMT CALCULATIONS IN MAIN PROGRAM

410	C	CAPABILITY ASSESSMENT WITH CONSTRAINED COST OR WITH CURRENT INVENTORY	
411	CC	REAL	THE AMOUNT OF INITIAL STOCK TO BE DISTRIBUTED IN THEATER OVER A SPECIFIED (PARTS DEPLOYMENT) TIME PERIOD (SEE IFDAY,ILDAY)
412	CC	REAL	LENGTH (DAYS) OF TIME PERIOD DURING WHICH INITIAL DEPOT SERVICEABLES ARE RECEIVED AT THEATER
413	CC	REAL	DELAY (DAYS AFTER DAY 1) BEFORE INITIAL DEPOT SERVICEABLES ARE RECEIVED AT THEATER
414	CC	REAL	FRACTION OF FLEET FLYING HR PROGRAM (FULL WAR) WHICH CAN BE ACHIEVED WITH THE CONSTR COST SOLUTION INVENTORY OR WITH 'CURRENT INVENTORY'
415	CC	REAL	PARTIAL SUB POLICY SCREENING LIMIT (INPUT). IF THE FAILURE RATE (FR(j)) FOR PART J EXCEEDS FRLIM, THEN PART J IS PUT IN THE FULL-SUB PART SET. IF NOT, IT'S IN THE NO-SUB PART SET.
416	CC	REAL	
417	CC	REAL	
418	CC	REAL	
419	CC	REAL	
420	CC	REAL	
421	CC	REAL	
422	CC	REAL	
423	CC	REAL	
424	CC	REAL	
425	CC	REAL	
426	CC	REAL	
427	CC	REAL	
428	CC	REAL	
429	CC	REAL	
430	CC	REAL	
431	CC	REAL	
432	CC	REAL	
433	CC	REAL	
434	CC	REAL	
435	CC	REAL	
436	CC	REAL	
437	CC	REAL	
438	CC	REAL	
439	CC	REAL	
440	CC	REAL	
441	CC	REAL	
442	CC	REAL	
443	CC	REAL	
444	CC	REAL	
445	CC	REAL	
446	CC	REAL	
447	CC	REAL	
448	CC	REAL	
449	CC	REAL	
450	CC	REAL	
451	CC	REAL	
452	CC	REAL	
453	CC	REAL	
454	CC	REAL	
455	CC	REAL	
456	CC	REAL	
457	CC	REAL	
458	CC	REAL	
459	CC	REAL	
460	CC	REAL	
461	CC	REAL	
462	CC	REAL	
463	CC	REAL	
464	CC	REAL	
465	CC	REAL	
466	CC	REAL	
467	CC	REAL	
468	CC	REAL	
469	CC	REAL	
470	CC	REAL	
471	CC	REAL	
472	CC	REAL	
473	CC	REAL	
474	CC	REAL	
475	CC	REAL	
476	CC	REAL	
477	CC	REAL	
478	CC	REAL	
479	CC	REAL	
480	CC	REAL	
481	CC	REAL	
482	CC	REAL	
483	CC	REAL	
484	CC	REAL	
485	CC	REAL	
486	CC	REAL	
487	CC	REAL	
488	CC	REAL	
489	CC	REAL	
490	CC	REAL	
491	CC	REAL	
	C	FIXED	FIRST DAY OF RECEIPT (IN THEATER) OF INITIAL STOCKS DISTRIBUTED (DEPLOYED) BY SUBROUTINE DIST
	CC	FIXED	INDICATOR TO SUBROUTINE CCLIST OF WHETHER CONSTR COST ALGORITHM 1 (IG=1) OR CONSTR COST ALGORITHM 2 WAS USED TO DETERMINE THE FINAL CONSTR COST SOLUTION
	CC	FIXED	LAST DAY OF RECEIPT (IN THEATER) OF INITIAL STOCKS DISTRIBUTED (DEPLOYED) BY SUBROUTINE DIST
	CC	FIXED	INDICATOR OF WHETHER TOTAL (INIT STK=0) OR RESIDUAL (INIT STK='CURRENT INVENTORY') REQMTS ARE BEING PROCESSED. IND=1 INDICATES TOTAL REQMTS. IND=2 INDICATES RESIDUAL REQMTS.
	CC	FIXED	RUN OPTION (INPUT). IF IOPT1 .LE. 0, THEN ONLY 'CURRENT INVENTORY' CAPABILITY ASSESSMENT CASES WILL BE DONE (I.E. NO REQMTS CALC). IF IOPT1 IS .GT. 0, BOTH Curr Inv CAP ASSESS AND REQMTS CASES WILL BE DONE.
	CC	FIXED	RUN OPTION (INPUT). IF IOPT2 .LE. 0, THEN THE FULL-SUB PART SET USED IN THE 'CURRENT INVENTORY' CAPABILITY ASSESSMENT CASES WILL NOT BE PRINTED. IF IOPT2 .GT. 0 THEY WILL.
	CC	FIXED	RUN OPTION (INPUT). IF IOPT3 .LE. 0, THEN THE NO-SUB PART SET USED IN THE 'Curr Inv' CAPABILITY ASSESSMENT CASES WON'T BE PRINTED. IF IOPT3 .GT. 0 THEY WILL BE PRINTED.
	CC	FIXED	RUN OPTION (INPUT). IF IOPT4 .LE. 0, THEN THE UNCONSTR COST SOLUTION REQMTS LIST WILL NOT BE PRINTED (BUT WILL BE COMPUTED INTERNALLY). IF IOPT4 .GT. 0 THE LIST WILL BE PRINTED.
	CC	FIXED	RUN OPTION (INPUT). IF IOPT5 .LE. 0, THEN THE 'CUMULATIVE (UNCONSTR COST) REQMTS COSTS THRU DAY N' LIST WILL NOT BE PRINTED. IF IOPT5 .GT. 0 THE LIST WILL BE PRINTED.
	CC	FIXED	RUN OPTION (INPUT). IF IORD .LE. 0, THEN THE SOLUTION REQMTS LISTS WILL BE ORDERED ACCORDING TO DECREASING UNIT COST OF PART. IF OPT3 .GT. 0 THE REQMTS LISTS ARE ORDERED BY (DECREASING) AMOUNT OF SOLUTION REQMT.
	CC	FIXED	INDICATOR TELLING THE CONSTR COST CAPABILITY ASSESSMENT ROUTINE (CCCAP) WHETHER TO PRINT THE AMOUNT OF SOLUTION REQMT. THIS IS SET BY THE MAIN PROGRAM.
	CC	FIXED	RUN OPTION (INPUT). IF TPRT .LE. 0, THEN THE SCENARIO INPUT DATA SUMMARY WILL NOT BE PRINTED

492 C
 493 C IF IPRT .GT. 0, IT WILL BE PRINTED
 494 C IPRT1 FIXED RUN OPTION(INPUT). IF IPRT1 .LE. 0, THEN THE
 495 C FULL-SUB & NO-SUB PART SETS USED IN REQMTS CASES
 496 C WILL NOT BE PRINTED, NOR WILL THE PART DATA
 497 C LIST SUMMARIES AFTER THE FIRST ONE. OTHERWISE
 498 C THESE WILL BE PRINTED.
 499 C
 500 C ISEL FIXED RUN OPTION(INPUT) TELLING WHETHER ONLY TOTAL
 501 C (INIT STK=0) REQMTS (ISEL=0), ONLY RESIDUAL
 502 C (INIT STK=CURR INV) REQMTS (ISEL=1), OR BOTH
 503 C TOTAL AND RESIDUAL REQMTS (ISEL=2) ARE TO BE
 504 C PROCESSED IN THIS RUN.
 505 C
 506 C IW FIXED TEMPORARILY STORES NW (THE NR DAYS IN THE WAR)
 507 C WHILE THE CONSTRAINED COST ALGORITHMS OPERATE.
 508 C
 509 C KNTC FIXED THE PARTIAL-SUB POLICY BEING PROCESSED. KNTC=1
 510 C IS THE POLICY USED IN REQMTS CALCULATIONS AND
 511 C IN THE 1ST "CURRENT INVENTORY" CAPABILITY
 512 C ASSESSMENT. KNTC=2,3,.. ARE ADDITIONAL POLICIES
 513 C (INPUT) USED ONLY IN CAPABILITY ASSESSMENTS
 514 C OF CURRENT INVENTORY
 515 C
 516 C LIMIT FIXED THE MAXIMUM NUMBER OF ITERATIONS (PER DAY)
 517 C WHICH THE CONSTRAINED COST CAPABILITY
 518 C ASSESSMENT ALGORITHM (SUBROUTINE CCCAP)
 519 C WILL PERFORM BEFORE IT TERMINATES
 520 C
 521 C NFS FIXED AN INPUT INDICATOR TELLING HOW THE FULL-SUB
 522 C SET USED IN REQMTS CALCULATIONS IS DEFINED.
 523 C IF NFS .LT. 0, THE FULL-SUB SET IS DEFINED
 524 C BY FOUR SCREENING LIMITS (BREPL, ZDCY, FRLIM,
 525 C ZNRTL) INPUT ON NEXT CARD. IF NFS .EQ. 0,
 526 C NO PARTS ARE TO BE IN THE FULL-SUB SET (I.E.
 527 C THIS IS A NO-SUB CASE). IF NFS .GT. 0, THEN
 528 C THE NFS (NUMBER OF) PART NUMBERS DESIGNATED
 529 C ON THE NEXT CARD(S) ARE IN THE FULL-SUB SET.
 530 C
 531 C NPTFS FIXED (INPUT) NUMBER OF FULL-SUB PARTS FOR EACH
 532 C PARTIAL-SUB POLICY USED ONLY FOR CAPABILITY
 533 C ASSESSMENT OF CURRENT INVENTORY. IF INPUT
 534 C VALUE OF NPTFS .GT. 0, THEN NPTNS (SEE BELOW)
 535 C IS IGNORED.
 536 C
 537 C NPTNS FIXED (INPUT) NUMBER OF NO-SUB PARTS FOR EACH
 538 C PARTIAL-SUB POLICY USED ONLY FOR CAPABILITY
 539 C ASSESSMENT OF CURRENT INVENTORY. NPTNS IS
 540 C USED ONLY IF THE VALUE OF NPTFS IS 0.
 541 C
 542 C TTFH REAL TOTAL FLYING HOURS IN THE FULL SCENARIO
 543 C FLYING PROGRAM
 544 C
 545 C ZCOST REAL TOTAL VALUE OF "CURRENT INVENTORY", BASED ON
 546 C PART UNIT COST
 547 C
 548 C ZDCY REAL PARTIAL SUB POLICY SCREENING LIMIT (INPUT).
 549 C IF THE DEPOT REPAIR CYCLE (DCY(J))
 550 C FOR PART J EXCEEDS ZDCY, THEN PART J IS PUT
 551 C IN THE FULL-SUB PART SET. IF NOT, IT'S IN THE
 552 C NO-SUB PART SET.
 553 C
 554 C ZNRTL REAL PARTIAL SUB POLICY SCREENING LIMIT (INPUT).
 555 C IF THE NRTS (ZNRTL(J)) FOR PART J EXCEEDS
 556 C ZNRTL, THEN PART J IS PUT IN THE FULL-SUB
 557 C PART SET. IF NOT, IT'S IN THE NO-SUB PART SET.
 558 C
 559 C
 560 C DIMENSION
 561 C * ALR(120), AM(61), BC(300), DAY1D(300),
 562 C * DC(300), DSER(300), DUNSER(300), FR(300),
 563 C * IDAY(61), NAC(61), NFH(61), OST(300),
 564 C * PT(24), WRES(300), WRESU(300), XRNCS(300),
 565 C * ZLOSS(61), ZNRT(300)
 566 C
 567 C COMMON
 568 C * AC(120), ACL, ADESC(370), ALLOW1(120),
 569 C * ALLOWB(120), AMSN(300), ASURV(120), AVAVG(6),
 570 C * AVM(120), BCY(300), BF(300), CASE,
 571 C * COMDA(300), CF(300), CL, CMIN,
 572 C * CNCS(300), COST(300), CRNCS(300), DCOST(300),
 573 C * DCOSTF(120), DCY(300), DF(300), DM(300),
 574 C * DOD(300), FHM, FHPAPD(3,120),

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574      •   FHR(120),      ICOST,      IDCC(2),      IFHC(120),
575      •   IFS(300),      IMSEL,      INS(300),      INT,
576      •   IPT(100),      IRC(300),      IRO(300),      ISHORT,
577      •   NP,          NP1,          NP2,          NW,
578      •   PTDEP(300,24),  QPA(300),      RNC(120),      RNCS(300),
579      •   SM(120,100),    SRMAX1(300),    STK(300),      SUMB(120),
580      •   TRNCS(300),    TSTK(300),    TSUMB,
581      CHARACTER*16
582      •   ADESC,        ADSC,        AMSN,        CASE,
583      •   CLASS(300),    Z1
584      ISHORT=0
585      IFCC=1
586      DO 100 I=1,2
587      100 IDCC(I)=0
588      DO 200 I=1,61
589      IDAY(I)=0
590      AVM(I)=0.
591      NAC(I)=0
592      NFH(I)=0
593      ZLOSS(I)=0
594      200 AM(I)=0
595      DO 300 I=1,300
596      IFS(I)=0
597      300 INS(I)=0
598      ZZ=0.
599      KNTC=1
600
C READ OST, OFFSET, DESIRED CONVERGENCE, MAX ESSENTIALITY PROCESSED,
C DEPOT LAG TIME, AND DEPOT DISTRIBUTION PERIOD
C
C      READ (11,9000) ADDOST, CONVF, IESS, DLAG, DDIS
C      NP=0
C      NP1=0
C
C READ INDICATOR(NFS) OF HOW PARTIAL-SUB POLICY IS DEFINED
C
C      READ (11,9100) NFS
C
C IF NFS .LT. 0 READ PARTIAL SUB SCREENING LIMITS ON DEPOT REPAIR CYCLE,
C NRTS, BASE(RETAIL) REPAIR CYCLE AND FAILURE RATE
C
C      IF (NFS.LT.0) READ (11,9200) ZDCY,ZNRTL,BREPL,FPLIM
C
C IF NFS .GT. 0, READ IN THE PART NUMBERS WHICH DEFINE THE FULL-SUB
C PART SET
C
C      IF (NFS.LE.0) GO TO 400
C      READ (11,9100) (IFS(J),J=1,NFS)
C      400 READ (11,9300) CASE
C      READ (10,9400)
C      I=0
C
C STMTS 500 TO 800 READ AND PROCESS THE PART DATA BASE INPUT. EACH PART
C HAS 12 RECORDS. THE READ ORDER IS: READ PART CHARACTERISTICS,
C SKIP A RECORD, READ INITIAL DEPOT STOCKS(SERV & UNSERV), INITIAL WAR
C RESERVES (SERV & UNSERV) AND IN-PLACE ASL/PLL. SKIP A RECORD.
C READ QUANTITY PER APPLICATION. READ PART DESCRIPTION. READ ASL/PLL
C DEPLOYED AFTER DAY 1. SKIP 3 RECORDS.
C
C      500 READ (10,9500,END=1300) Z1,Z2,Z3,Z4,Z5,Z6,Z7,Z8,Z9,IES
C      READ (10,9600,END=1300) DSRV,DUNS,WRS,MRU,DAY1
C      READ (10,9700,END=1300) IQPA
C      READ (10,9800,END=1300) ADESC
C      READ (10,9900,END=1300) (PT(K),K=1,24)
C      READ (10,9400,END=1300)
C
C DO NOT PROCESS PARTS WITH A AN ESSENTIALITY .GT. IESS
C
C      IF (IES.GT.IESS) GO TO 700
C      ZT=Z3+ADDOST
C      ZXD=2.*ZT*Z7
C      Z2C=Z2/100.
C      Z4F=Z4/1000000.
C      Z5N=Z5/100.
C      Z100=IQPA
C      Z8B=Z8/100.
C      Z90=Z9/100.
C      IF (MOD(NP+1,50).NE.0) GO TO 630
C      WRITE (6,10000) CASE
C      WRITE (6,10100)
C      WRITE (6,10200)
C      WRITE (6,10300)

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656      C DO NOT PROCFS PARTS WITH A FAILURE RATE =0.
658      C
659      600 IF (Z4.GE..00000001) GO TO 800
660      700 WRITE (6,10400) Z1,ADSC,22C,Z3,Z4F,Z5N,Z6,ZXD,Z7,Z88,Z9D,Z10Q,IES
661      I=I+1
662      GO TO 500
663      800 NP=NP+1
664
665      C COMPUTE INITIAL STOCK IN THEATER AS SERVICEABLE WAR RESERVE +
666      C IN-PLACE ASL/PLL
667      C
668      STK(NP)=WRS*DAY1
669      BCY(NP)=Z6
670      DCY(NP)=0
671      IF (Z5N.GT.0) DCY(NP)=ZXD
672      ZNRT(NP)=Z5N
673      CLASS(NP)=* NO SUB*
674
675      C IF NFS .LT. 0, LABEL THE FULL-SUB PARTS ACCORDING TO THEIR EXCEEDING
676      C AT LEAST ONE OF THE SCREENING LIMITS
677      C
678      IF (NFS.GE.0) GO TO 900
679      CLASS(NP)=FULL SUB*
680      IF (BCY(NP).LE.BREPL.AND.DCY(NP).LE.ZDCY.AND.ZNF.LE.FRLIM.AND.ZNRT
681      +(NP).LE.ZNRTL) CLASS(NP)=* NO SUB*
682      GO TO 1100
683      900 IF (NFS.EQ.0) GO TO 1100
684      DO 1000 L=1,NFS
685      IF (IFS(L).NE.NP) GO TO 1000
686      CLASS(NP)=FULL SUB*
687      GO TO 1100
688      1000 CONTINUE
689      1100 WRITE (6,10500) NP,Z1,ADSC,22C,Z3,Z4F,Z5N,Z6,ZXD,Z7,Z88,Z9D,Z10Q,I
690      +ES,CLASS(NP),STK(NP)
691      O5T(NP)=ZT
692      AMSN(NP)=Z1
693      COST(NP)=Z2C
694      FR(NP)=Z4F
695      BC(NP)=Z8R
696      DC(NP)=Z9D
697      QPA(NP)=Z100
698      ADESC(NP)=ADSC
699      DSER(NP)=DSRV
700      DUNSER(NP)=DUNS
701      WRES(NP)=WRS
702      WRESU(NP)=WRU
703      DAY1D(NP)=DAY1
704      DO 1200 L=1,24
705      1200 PTDEP(NP,L)=PT(L)
706      IF (NFS.GE.0.OR.CLASS(NP).EQ.* NO SUB*) GO TO 500
707
708      C IF NFS .LT. 0, STORE THE PART NUMBERS OF THE FULL-SUB PART SET
709      C PREVIOUSLY LABELED
710      C
711      NP1=NP1+1
712      IFS(NP1)=NP
713      GO TO 500
714      1300 II=NP+I
715      IF (NFS.GE.0) NP1=NFS
716      WRITE (6,10600) II,NP
717
718      C READ COST LIMIT(TOTAL RQMTS),COST LIMIT(ADD-ON RQMTS) AND ITERATION
719      C LIMIT
720      C
721      READ (11,10700) CLNCR,CLNCT,LIMIT
722
723      C READ MAX FH/ACFT/DAY, NR DAYS IN WAR, TYPE RQMTS TO CALCULATE, DESIRED
724      C ORDER OF RQMTS OUTPUT AND VARIOUS PRINT OPTIONS
725      C
726      READ (11,10800) FHM,NW,ISFL,IORD,IOPT1,IOPT2,IOPT3,IOPT4,IOPT5,IPR
727      +T,IPRT1
728      I4T=1
729      IF (NP1.EQ.0.OR.IPRT1.LE.0) GO TO 1500
730
731      C PRINT THE LIST OF FULL-SUB PARTS USED IN THE RQMTS CASES
732      C
733      DO 1400 I=1,NP1
734      II=IFS(I)
735      IF (MOD(I,-1,50).NE.0) GO TO 1400
736      WRITE (6,10A001) CASE
737      WRITE (6,10900) KNTC

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738      WRITE (6,10200)
739      WRITE (6,10300)
740      1400 WRITE (6,11000) II,AMSN(II),ADESC(II),COST(II),FR(II),ZNRT(II),BCY
741      +(II),DCY(II),BC(II),DC(II),STK(II)
742      1500 NP2=0
743
744      C DEFINE THE NO-SUB PART SET (INS(J)) AS ALL PARTS NOT DESIGNATED FOR
745      C THE FULL-SUB PART SET
746
747      DO 1800 K=1,NP
748      IF (NP1.EQ.0) GO TO 1700
749      DO 1600 I=1,NP1
750      IF (IFS(I).EQ.K) GO TO 1800
751      1600 CONTINUE
752      1700 NP2=NP2+1
753      INS(NP2)=K
754      1800 CONTINUE
755      IF (NP2.EQ.0.OR.IPRT1.LE.0) GO TO 2000
756
757      C PRINT THE LIST OF NO-SUB PARTS USED IN THE REQMTS CASES
758
759      DO 1900 I=1,NP2
760      II=INS(I)
761      IF (MOD(I-1,50).NE.0) GO TO 1900
762      WRITE (6,10000) CASE
763      WRITE (6,11100) KNTC
764      WRITE (6,10200)
765      WRITE (6,10300)
766      1900 WRITE (6,11200) II,AMSN(II),ADESC(II),COST(II),FR(II),ZNRT(II),BCY
767      +(II),DCY(II),BC(II),DC(II),STK(II)
768
769      C READ IN THE CUMULATIVE NUMBER OF ACFT DEPLOYED (FOR EACH DAY INTERVAL)
770
771      2000 READ (11,9100) NACDEP
772      READ (11,9100) (IDAY(I),I=1,NACDEP)
773      READ (11,9100) (NAC(I),I=1,NACDEP)
774      DO 2200 I=1,NACDEP
775      K1=IDAY(I)
776      K2=IDAY(I+1)-1
777      IF (I.EQ.NACDEP) K2=NW
778      DO 2100 J=K1,K2
779      AC(J)=NAC(I)
780      2200 CONTINUE
781
782      C READ IN THE PROGRAM FLYING HOURS (FOR EACH DAY INTERVAL)
783
784      READ (11,9100) NFHDAY
785      READ (11,9100) (IDAY(I),I=1,NFHDAY)
786      READ (11,9100) (NFH(I),I=1,NFHDAY)
787      DO 2400 I=1,NFHDAY
788      K1=IDAY(I)
789      K2=IDAY(I+1)-1
790      IF (I.EQ.NFHDAY) K2=NW
791      DO 2300 J=K1,K2
792      FMA(J)=NFH(I)
793      2300 FHR(J)=NFH(I)
794      2400 CONTINUE
795
796      C READ IN THE NUMBER OF ACFT LOST(ATTRITION) IN EACH DAY INTERVAL
797
798      READ (11,9100) NLDAY
799      READ (11,9100) (IDAY(I),I=1,NLDAY)
800      READ (11,11300) (ZLOSS(I),I=1,NLDAY)
801      DO 2600 I=1,NLDAY
802      K1=IDAY(I)
803      K2=IDAY(I+1)-1
804      IF (I.EQ.NLDAY) K2=NW
805      DO 2500 J=K1,K2
806      2500 ALR(J)=ZLOSS(I)
807      2600 CONTINUE
808
809      C READ THE DESIRED MINIMUM ACFT AVAILABILITY OBJECTIVE FOR EACH DAY INTERVAL
810
811      READ (11,9100) NMDAY
812      READ (11,9100) (IDAY(I),I=1,NMDAY)
813      READ (11,11400) (AM(I),I=1,NMDAY)
814      DO 2800 I=1,NMDAY
815      K1=IDAY(I)
816      K2=IDAY(I+1)-1
817      IF (I.EQ.NMDAY) K2=NW
818      DO 2700 J=K1,K2
819      2700 AVM(J)=AM(I)

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820      2800 CONTINUE
821
822      C READ (UP TO 100) PART NUMBERS OF PARTS SELECTED TO HAVE * CUMUL
823      C REQMT THRU DAY N* OUTPUT FOR EACH DAY N OF THE SCENARIO
824
825      C      READ (11,9100) IMSEL
826      C      READ (11,9100) (IPT(K),K=1,IMSEL)
827      C      IF (IPT(1).LE.0) GO TO 3300
828      C      ZCOST=0.
829
830      C      THRU STMT 3500, PROCESS ALL PART DEPLOYMENTS
831
832      C      DO 3000 K=1,NP
833      C      SUM=0.
834
835      C      FOR EACH PART, CALCULATE TOTAL ASL/PLL DEPLOYMENTS (SUM), TOTAL
836      C      NON-CONDEMNED PARTS (SUMT) AND VALUE OF ENTIRE CURRENT INVENTORY.
837      C      PRINT SUMMARY PART DEPLOYMENTS FOR EACH PART (IN ORDER OF INPUT)
838
839      C      DO 2900 I=1,24
840      C      SUM=SUM+PTOEP(I,I)
841      C      SUMT=SUM+DSER(IK)*(1.0-DC(IK))*WRES(IK)*DAY1D(IK)*(1.0-ZNRT(I
842      C      * K))+WRESU(IK)*(1.0-BC(IK))*ZNRT(IK)*WRESU(IK)*(1.0-DC(IK))
843      C      ZCOST=ZCOST+SUMT*COST(IK)
844      C      IF (IMOD(IK-1,5)).NE.0) GO TO 3000
845      C      WRITE (16,10000) CASE
846      C      WRITE (16,11500)
847      C      WRITE (16,10100)
848      C      WRITE (16,10300)
849      C      WRITE (16,11600)
850      C      WRITE (16,10300)
851      C      3000 WRITE (16,11700) K,AMSN(IK),ADESC(IK),COST(IK),CLASS(IK),DSER(IK),DUNS
852      C      *ERIK,WRES(IK),WRESU(IK),DAY1D(IK),SUM,SUMT
853      C      DO 3200 K=1,NP
854      C      IF (IMOD((K-1)*3,60)).NE.0) GO TO 3100
855      C      WRITE (16,10000) CASE
856      C      WRITE (16,11800)
857      C      WRITE (16,11900)
858      C      WRITE (16,12000)
859      C      WRITE (16,10300)
860
861      C      PRINT THE UNADJUSTED (I.E., ASL/PLL ONLY) PARTS DEPLOYMENT
862
863      C      3100  WRITE (16,12100) K,AMSN(IK),ADESC(IK)
864      C      3200 WRITE (16,12200) (PTOEP(IK,L),L=1,24)
865
866      C      THRU STMT 3500, DISTRIBUTE INITIAL (SERV & UNSERV) DEPOT AND INITIAL
867      C      (SERVICEABLE) WAR RESERVE STOCKS OVER DAYS. IN EACH DISTRIBUTION
868      C      IFDAY IS FIRST DAY OF RECEIPT, ILDAY IS LAST DAY AND DAMT IS
869      C      AMOUNT RECEIVED PER DAY.
870
871      C      3300 DO 3500 K=1,NP
872      C      IFDAY=DLAG+1
873      C      ILDAY=DLAG+DDIS
874      C      DAMT=DSER(IK)/DDIS
875
876      C      INITIAL DEPOT SERVICEABLES ARE DISTRIBUTED
877
878      C      CALL DIST (IFDAY,ILDAY,DAMT,K)
879      C      IFDAY=OST(IK)+1
880      C      DREP=DCY(IK)-2.0*OST(IK)
881      C      X=DREP
882      C      IF (DREP.LT.1.0) DREP=1.000
883      C      ILDAY=OST(IK)+DREP
884      C      DAMT=((1.0-DC(IK))*DUNSER(IK))/DREP
885
886      C      INITIAL DEPOT UNSERVICEABLES ARE DISTRIBUTED (LESS CONDEMNATIONS)
887
888      C      CALL DIST (IFDAY,ILDAY,DAMT,K)
889      C      AMT=(1.0-ZNRT(IK))*WRESU(IK)*(1.0-BC(IK))
890      C      IFDAY=1
891      C      IF (BCY(IK).LT.1.0) BCY(IK)=1.
892      C      ILDAY=BCY(IK)
893      C      DAMT=AMT/BCY(IK)
894
895      C      INITIAL UNSERVICEABLE WAR RESERVES REPAIRED AT RETAIL ARE DISTRIBUTED
896
897      C      CALL DIST (IFDAY,ILDAY,DAMT,K)
898      C      AMT=ZNRT(IK)*WRESU(IK)*(1.0-DC(IK))
899      C      IFDAY=1.0+2.0*OST(IK)
900      C      ILDAY=2.0*OST(IK)+DREP
901      C      DAMT=AMT/DREP

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902      C INITIAL UNSERVICEABLE WAR RESERVES REPAIRED AT DEPOT ARE DISTRIBUTED
903      C INITIAL SERVICEABLE WAR RESERVES, ALREADY IN-PLACE, ARE NOT DISTRIBUTED
904      C
905      C     CALL DIST (IPRT1,ILDAY,DAMT,K)
906      IF (IPRT1.LE.0) GO TO 3500
907      IF (MOD((K-1)+3,60).NE.0) GO TO 3400
908      WRITE (6,10000) CASE
909      WRITE (6,12300)
910      WRITE (6,11900)
911      WRITE (6,12000)
912      WRITE (6,10300)
913
914      C WRITE PART ID. IF THE PART IS AN INITIAL DEPOT UNSERVICEABLE WITH
915      C A REPAIR TIME=0, PRINT A WARNING
916      C
917      3400  IF (X.GE..0001.OR.DAMT.LE..301) WRITE (6,12100) K,AMSN(K),A
918      + DESC(K)
919      IF (X.LT..0001.AND.DAMT.GT..301) WRITE (6,12400) K,AMSN(K),A
920      + DESC(K)
921
922      C PRINT THE ADJUSTED (INITIAL UNSERVICEABLE DEPOT & WAR RES STKS &
923      C ASL/PLL DEPLOYED AFTER DAY 1) PARTS DEPLOYMENT (EXCLUDES IN-PLACE
924      C ASL/PLL AND SERVICEABLE WAR RESERVES)
925      C
926      WRITE (6,12200) (PTDEPIK,L),L=1,24
927      3500 CONTINUE
928      IF (IPRT.LE.0) GO TO 3800
929
930      C PRINT THE SCENARIO INPUT DATA SUMMARY
931      C
932      DO 3700 J=1,NW
933      IF (MOD(J-1,5).NE.0) GO TO 3600
934      WRITE (6,10000) CASE
935      WRITE (6,12500)
936      WRITE (6,12600) ADDOST,CONVF,LIMIT,IESS
937      WRITE (6,12700) FHM,CLNCR,CLNCT
938      WRITE (6,12800) ZCOST
939      WRITE (6,12900)
940      WRITE (6,13000)
941      WRITE (6,13100) CALRECAL+ALRI(J)
942      3600  WRITE (6,13100) J,AC(J),FMR(J),AVM(J),ALRI(J),CALR
943      3700  WRITE (6,10000) CASE
944      3800  WRITE (6,10000) CASE
945      WRITE (6,13200)
946
947      C PRINT A REPORT SUMMARIZING OPTIONS SELECTED FOR THIS RUN
948      C
949      IF (ISEL.EQ.0) WRITE (6,13300) ISEL
950      IF (ISEL.EQ.1) WRITE (6,13400) ISEL
951      IF (ISEL.EQ.2) WRITE (6,13500) ISEL
952      IF (NFS.LT.0) WRITE (6,13600) NFS,ZDCY,ZNRTL,BREPL,FRLIM
953      IF (NFS.GE.0) WRITE (6,13700) NFS
954      IF (IORD.LE.0) WRITE (6,13800) IORD
955      IF (IORD.GT.0) WRITE (6,13900) IORD
956      IF (IOP1.LE.0) WRITE (6,14000) IOP1
957      IF (IOP1.GT.0) WRITE (6,14100) IOP1
958      IF (IOP2.LE.0) WRITE (6,14200) IOP2
959      IF (IOP2.GT.0) WRITE (6,14300) IOP2
960      IF (IOP3.LE.0) WRITE (6,14400) IOP3
961      IF (IOP3.GT.0) WRITE (6,14500) IOP3
962      IF (IOP4.LE.0) WRITE (6,14600) IOP4
963      IF (IOP4.GT.0) WRITE (6,14700) IOP4
964      IF (IOP5.LE.0) WRITE (6,14800) IOP5
965      IF (IOP5.GT.0) WRITE (6,14900) IOP5
966      IF (IPRT.LE.0) WRITE (6,15000) IPRT
967      IF (IPRT.GT.0) WRITE (6,15100) IPRT
968      IF (IPRT1.LE.0) WRITE (6,15200) IPRT1
969      IF (IPRT1.GT.0) WRITE (6,15300) IPRT1
970      WRITE (6,15400) INT,INT
971      DO 3900 I=1,NW
972      3900 DCOSTF(I)=0.
973      DO 4000 I=1,NP
974      4000 DOD(I)=COST(I)
975      KNT=0
976
977      C ORDER THE NO-SUB PART SET ACCORDING TO DECREASING UNIT COST (MOST
978      C EXPENSIVE PART FIRST)
979      C
980      NODUMMY=NP
981      DO 4300 K=1,NP
982      CALL MAXC (NODUMMY,NOUT)
983      ITC(K)=NOUT

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984      II=IRC(K)
985      IF (NP1.LE.0) GO TO 4200
986      DO 4100 L=1,NP1
987          IF (IFSIL).EQ.II) GO TO 4300
988      4100  CONTINUE
989      4200  KNT=KNT+1
990          INS(KNT)=II
991      4300  DO0(III)=1
992          IF (IPRT1.LE.0) GO TO 4600
993
994      C PRINT SUMMARY PART DEPLOYMENTS FOR EACH PART (IN ORDER OF UNIT COST)
995      C
996      DO 4500 K=1,NP
997          II=IRC(K)
998          IF (MOD(K-1,51).NE.0) GO TO 4500
999          WRITE (6,10000) CASE
1000          WRITE (6,15500)
1001          WRITE (6,10300)
1002          WRITE (6,11650)
1003          WRITE (6,10300)
1004      4500  WRITE (6,11700) K,II,AMSN(II),ADESC(II),COST(II),CLASS(II)
1005      4600  CALR=0.
1006
1337      C COMPUTE THE MINIMUM NUMBER OF ACFT(ALLOWB(I)), REQUIRED TO MEET THE FLYING
1008      C PROGRAM/AVAILABILITY OBJECTIVE FOR EACH DAY I
1009      C
1010      WRITE (6,15600)
1011      DO 4700 I=1,NW
1012          CALR=CALR+ALR(I)
1013          ASURV(I)=AC(I)-CALR
1014          XX=AMAX1(0.,ASURV(I)*(1.-AVH(I)))
1015          YY=AMAX1(0.,ASURV(I)-FHR(I)/FHM)
1016          ALLOWB(I)=AMIN1(XX,YY)
1017          IF (ALLOWB(I).EQ.YY) IFHC(I)=0
1018          IF (ALLOWB(I).EQ.XX) IFHC(I)=1
1019      4700  CONTINUE
1020      TTFH=0.000001
1021
1022      C COMPUTE TOTAL FLYING HOURS IN THE FULL FLYING PROGRAM
1023      C
1024      DO 4800 I=1,NW
1025          4800  TTFH=TTFH+FHR(I)
1026
1027      C COMPUTE COEFFICIENTS USED BY FUNCTION SR IN THE CALCULATION OF
1028      C NET DEMAND
1029      C
1030      DO 4900 J=1,NP
1031          CF(J)=FR(J)*QPA(J)
1032          BF(J)=(1.-BC(J))*(1.-ZNRT(J))*CF(J)
1033          DF(J)=(1.-DC(J))*(ZNRT(J))*CF(J)
1034      4900  CONTINUE
1035
1036      C IF ONLY ASSESSMENT CASES ARE TO BE PROCESSED, SKIP REQMT CALCULATIONS
1037      C
1038          IF (IOPT1.LE.0) GO TO 7600
1039          IND1=1
1040          IND2=2
1041
1042      C DETERMINE WHETHER ONLY RESIDUAL RQMTS (ISEL=0), ONLY TOTAL RQMTS (ISEL=1),
1043      C OR BOTH RESIDUAL AND TOTAL RQMTS (ISEL=2) ARE TO BE DONE IN THIS RUN
1044      C
1045          IF (ISEL.EQ.2) GO TO 5000
1046          IND1=1+ISEL
1047          IND2=1+ISEL
1048
1049      C THRU STMT 7500 PROCESS ALL REQUIREMENTS CALCULATIONS AND ASSOCIATED
1050      C CAPABILITY ASSESSMENTS FOR BOTH UNCONSTRAINED COST AND CONSTRAINED
1051      C COST CASES
1052      C
1053      5000  DO 7500 IND=IND1,IND2
1054          ACL=0.
1055          CL=CLNCT
1056          ICOST=0
1057          IF (IND.EQ.2) CL=CLNCR
1058
1059      C CALL SUBROUTINE UCRQPS TO COMPUTE THE UNCONSTRAINED COST REQMTS
1060      C SOLUTION. THEN CALL SUBROUTINE UCCAP TO GENERATE THE CAPABILITY
1061      C ASSESSMENT BASED ON THE UNCONSTRAINED COST SOLUTION
1062      C
1063          CALL UCRQPS (IND,IOPT4,IOPTS,IORD)
1064          CALL UCCAP (IND)
1065      C

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1066 C FOLLOWING STMTS THRU STMT 7600 PROCESS THE CONSTRAINED COST CASE.
1067 C IF THE COST LIMIT (CL) IS NEGATIVE, OMIT CONSTRAINED COST PROCESSING
1068 C
1069 C           IF (CL.LE.0.) GO TO 7500
1070 C           IW=NW
1071 C           UCNS=0.
1072 C           FRAC1=0.
1073 C
1074 C IF THIS IS A FULL SUB CASE, OMIT CONSTR COST ALGORITHM 1 AND ONLY
1075 C PROCESS CONSTR COST ALGORITHM 2
1076 C
1077 C           IF (NP2.EQ.0.) GO TO 6600
1078 C
1079 C UP TO STMT 6600 PROCESS THE CONSTR COST SOLUTION FOR ALGORITHM 1
1080 C
1081 C
1082 C RECOMPUTE THE COST OF THE UNCONSTR COST SOLUTION
1083 C
1084 C           DO 5100 J=1,NP2
1085 C           II=INS(J)
1086 C           UCNS=UCNS+COST(II)*RNCS(II)
1087 C           WRITE (5,10000) CASE
1088 C           WRITE (6,15700)
1089 C
1090 C SAVE THE UNCONSTR COST SOLUTION IN AN ARRAY
1091 C
1092 C           DO 5200 J=1,NP
1093 C           TRNCS(J)=RNCS(J)
1094 C
1095 C THRU STMT 5800, THE STANDARD PARCOM NO-SUB CONSTR COST ALGORITHM
1096 C OPERATES ON THE NO-SUB PART SET.
1097 C
1098 C           CL1=CL
1099 C           CNC=CMINT-CL
1100 C
1101 C CNC IS THE $ AMOUNT OF THE UNCONSTR COST SOLUTION WHICH IS NOT AFFORDABLE
1102 C AND SO MUST BE "UNBOUGHT". IF CNC .LT. 0, THEN THE UNCONSTR COST
1103 C SOLUTION IS ALSO THE CONSTR COST SOLUTION
1104 C
1105 C           IF (CNC.GT.0.) GO TO 5300
1106 C           IF (IND.EQ.1) WRITE (6,15800)
1107 C           IF (IND.EQ.2) WRITE (6,15900)
1108 C           GO TO 7500
1109 C
1110 C UNDER ALGORITHM 1 LOGIC, THE NO-SUB PART SET REQMT IS "BOUGHT" FIRST
1111 C (OR, EQUIVALENTLY, THE FULL-SUB SET REQMT IS "UNBOUGHT" FIRST).
1112 C IF CNC .LT. 0, THE COST OF THE FULL-SUB PARTS IN THE UNCONSTR COST
1113 C SOLUTION (DCOST1(NW)), THEN THE ENTIRE UNCONSTR COST NO-SUB REQMT
1114 C IS "BOUGHT" AND PART OF THE UNCONSTR COST FULL-SUB REQMT MUST BE
1115 C "UNBOUGHT", OTHERWISE THE ENTIRE UNCONSTR COST FULL-SUB REQMT IS
1116 C "UNBOUGHT" AND ONLY PART OF THE NO-SUB REQMT MUST BE "BOUGHT".
1117 C
1118 C           5300 IF (CNC.GT.DCOST1(NW)) GO TO 5400
1119 C           CL1=UCNS
1120 C           CL2=CL-CL1
1121 C           GO TO 5900
1122 C
1123 C           5400 IF (NP1.EQ.0.) GO TO 5600
1124 C
1125 C BEFORE STARTING ALGORITHM 1 PROCESSING, INITIALIZE FULL-SUB REQUIREMENTS TO 0
1126 C
1127 C           DO 5500 J=1,NP1
1128 C           II=IFS(J)
1129 C           RNCS(II)=0.
1130 C
1131 C TRNCS STORES THE NO-SUB PARTS MIX PORTION OF THE SOLUTION FOR
1132 C ALGORITHM 1
1133 C
1134 C           5600 CL2=0.
1135 C           CL1=CL-CL2
1136 C           CNC=UCNS-CL1
1137 C           DO 5800 J=1,NP2
1138 C           II=INS(J)
1139 C           C=TRNCS(II)*COST(II)
1140 C           IF (C.LT.CNC) GO TO 5700
1141 C           TRNCS(II)=TRNCS(II)-CNC/COST(II)
1142 C           IW=NW
1143 C           GO TO 6200
1144 C           5700 TRNCS(II)=0.
1145 C           CNC=CNC-C
1146 C           5800 CONTINUE
1147 C           5900 IFCC=1

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1148
1149      C DETERMINE IFCC, THE LAST DAY N FOR WHICH 'CUM FULL-SUB REQMT COST
1150      C THRU DAY N' IS .LE. CL2 (THE AFFORDABLE AMOUNT OF FULL-SUB PARTS)
1151      C
1152      DO 6000 I=1,NW
1153      IF (DCOST1(I).GT.CL2) GO TO 6000
1154      IFCC=I
1155      BCL=DCOST1(I)
1156      6000  CONTINUE
1157      WRITE (6,16000)
1158      IF (CL2.GE.DCOST1(NW)) WRITE (6,16100)
1159      IF (CL2.LT.DCOST1(NW)) WRITE (6,16200) CL2,BCL,IFCC
1160      IW=NW
1161      NW=IFCC
1162
1163      C GENERATE THE FULL-SUB PARTS MIX ASSOCIATED WITH DAY IFCC
1164      C
1165      CALL UCPQPS (IND,IOPT4,IOPT5,IORD)
1166      6200  WRITE (6,16300) CL,CL1
1167      WRITE (6,16300)
1168      IF (CL2.LE..00001) WRITE (6,16400)
1169      NW=IW
1170
1171      C MERGE THE JUST-COMPUTED FULL-SUB MIX (SUSTAINABILITY SOLUTION)
1172      C JUST COMPUTED WITH THE NO-SUB MIX 'BOUGHT' EARLIER AND STORE
1173      C THIS COMBINED SOLUTION (FOR CONSTR COST ALGORITHM 1) IN TRNCS
1174      C
1175      DO 6300 I=1,NPZ
1176      II=INS(I)
1177      6300  RNCS(I)=TRNCS(I)
1178      DO 6400 I=1,NP
1179      6400  TRNCS(I)=RNCS(I)
1180      TOT=0
1181      DO 6500 I=1,NP
1182      TOT=TOT+COST(I)*RNCS(I)
1183      6500  RNCS(I)=RNCS(I)+STK(I)*(IND-1)
1184      IP=0
1185
1186      C CALL THE CAPABILITY ASSESSMENT ROUTINE (BUT DON'T PRINT RESULTS)
1187      C TO COMPUTE FNC, THE FRACTION FRACTION OF THE FLYING PROGRAM ACHIEVED
1188      C USING THE ALGORITHM 1 SOLUTION
1189      C
1190      CALL CCCAP (IND,LIMIT,CONVF,TTFH,KNTC,IP,FNC)           NEW
1191      FRAC1=FNC
1192      WRITE (6,16500) FRAC1
1193
1194      C THRU STMT 6800, GENERATE THE SOLUTION FOR CONSTR COST ALGORITHM 2.
1195      C STORE THAT SOLUTION IN ARRAY XRNCS.
1196      C SUBROUTINE UCRQPS HAS ALREADY DETERMINED IDCC(IND), THE LAST DAY N
1197      C FOR WHICH 'CUM TOTAL(I.E. ALL PARTS) REQMT COST THRU DAY N'
1198      C IS .LE. CL, THE (INPUT) COST LIMIT.
1199      C
1200      IF (IDCC(IND).LE.1.OR.IDCC(IND).GE.NW) GO TO 7500
1201      NW=IDCC(IND)
1202      DO 6700 I=1,NW
1203      6700  FMA(I)=FMA(I)
1204      CALL UCRQPS (IND,IOPT4,IOPT5,IORD)
1205      DO 6800 J=1,NP
1206      XRNCS(J)=RNCS(J)
1207      NW=IW
1208      IP=0
1209      6800  RNCS(J)=RNCS(J)+STK(J)*(IND-1)
1210
1211      C CALL THE CAPABILITY ASSESSMENT ALGORITHM TO COMPUTE THE FRACTION
1212      C FLYING PROGRAM COMPLETED WITH THE ALGORITHM 2 SOLUTION (BUT DON'T PRINT IT)
1213      C
1214      CALL CCCAP (IND,LIMIT,CONVF,TTFH,KNTC,IP,FNC)
1215      FRAC2=FNC
1216      WRITE (6,16600) FRAC2
1217
1218      C CHOOSE THE CONSTR COST ALGORITHM SOLUTION WHICH GIVES THE HIGHER
1219      C FRACTION FLYING PROGRAM ACHIEVED AND CALL SUBROUTINE CCLIST TO PRINT
1220      C THE SELECTED SOLUTION
1221      C
1222      IF (FRAC1.LE.FRAC2) GO TO 7100
1223      DO 6900 J=1,NP
1224      RNCS(J)=TRNCS(J)
1225      IG=1
1226      ACL=TOT
1227      CALL CCLIST (IG,IORD,IND)
1228      DO 7000 J=1,NP
1229      RNCS(J)=TRNCS(J)+STK(J)*(IND-1)

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1230      IP=1
1231      CALL CCCAP (IND,LIMIT,CONVF,TTFH,KNTC,IP,FNC)
1232      GO TO 7400
1233      7100  IP=2
1234      DO 7200 J=1,NP
1235      7200  RNCS(J)=XRNCS(J)
1236      CALL CCLIST (IG,IORD,IND)
1237      DO 7300 J=1,NP
1238      7300  RNCS(J)=XRNCS(J)+STK(J)*(IND-1)
1239      IP=1
1240
1241      C CALL THE CAPABILITY ASSESSMENT ALGORITHM AGAIN TO PRINT OUT ASSESSMENT
1242      C RESULTS FOR THE SELECTED CONSTR COST SOLUTION
1243      C
1244      CALL CCCAP (IND,LIMIT,CONVF,TTFH,KNTC,IP,FNC)
1245      7400  NW=IW
1246      DO 7450 I=1,NW
1247      7450  FHA(I)=FHR(I)
1248      7500  ICOST=0
1249
1250      C THRU STMT 8900 DO CAPABILITY ASSESSMENT OF "CURRENT INVENTORY"
1251      C UNDER VARIOUS PARTIAL-SUB POLICIES
1252
1253      C
1254      7600  DO 7700 K=1,NP
1255      7700  RNCS(K)=STK(K)
1256      IP=1
1257      IND=2
1258
1259      C DO A CAPABILITY ASSESSMENT FOR THE PART-SUB POLICY USED IN THE
1260      C REQMTS CALCULATIONS
1261      CALL CCCAP (IND,LIMIT,CONVF,TTFH,KNTC,IP,FNC)
1262      KNTC=2
1263
1264      C RESET STOCK TO INITIAL LEVELS AND CLEAR FULL-SUB AND NO-SUB PART
1265      C ARRAYS PRIOR TO RESETTING THEM(FOR A NEW PART-SUB POLICY)
1266
1267      C
1268      7800  DO 7900 K=1,NP
1269      RNCS(K)=STK(K)
1270      INS(K)=0
1271      7900  IFS(K)=0
1272
1273      C READ ANOTHER PART-SUB POLICY IN TERMS OF EITHER THE NR & DESIGNATION
1274      C OF FULL-SUB PARTS(IF NPTFS .GT. 0) OR ELSE THE NR & DESIGNATION
1275      C OF OF NO-SUB PARTS (IF NPTNS .GT.0) . ONLY ONE SET IS READ.
1276
1277      READ (11,9100) END=16700, NPTFS, NPTNS
1278      IF (NPTFS+NPTNS).LE.0) GO TO 16700
1279
1280      C READ IN THE DESIGNATED FULL-SUB PARTS FOR THIS POLICY. ALL OTHER
1281      C PARTS ARE, BY DEFAULT, NO-SUB PARTS.
1282
1283      NP1=NPTFS
1284      READ (11,9100) (IFS(I),I=1,NPTFS)
1285      NP2=0
1286      DO 8100 K=1,NP
1287      DO 8000 I=1,NP1
1288      IF (IFS(I).EQ.K) GO TO 8100
1289      8000  CONTINUE
1290      NP2=NP2+1
1291      INS(NP2)=K
1292
1293      8100  CONTINUE
1294      GO TO 8500
1295      8200  NP2=NPTNS
1296
1297      C READ IN THE DESIGNATED NO-SUB PARTS FOR THIS POLICY. ALL OTHER
1298      C PARTS ARE, BY DEFAULT, FULL-SUB PARTS.
1299
1300      READ (11,9100) (INS(I),I=1,NPTNS)
1301      NP1=0
1302      DO 8400 K=1,NP
1303      DO 8300 I=1,NP2
1304      IF (INS(I).EQ.K) GO TO 8400
1305      8300  CONTINUE
1306      NP1=NP1+1
1307      IFS(NP1)=K
1308      8400  CONTINUE
1309      8500  IF (IOPT2.LE.0) GO TO 8700
1310
1311      C PRINT THE COMPOSITION OF THE FULL-SUB PART SET FOR THIS PART-SUB
      C POLICY

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1312      C
1313      DO 8600 I=1,NP1
1314      II=IFS(I)
1315      IF (MOD(I-1,50).NE.0) GO TO 8600
1316      WRITE (6,10000) CASE
1317      WRITE (6,10900) KNTC
1318      WRITE (6,10200)
1319      WRITE (6,10300)
1320      8600 WRITE (6,11000) IT,AMSN(IT),ADESC(II),COST(II),FR(II),ZNRT(II),BCY
1321      * (II),DCY(II),BC(II),DC(II),STK(II)
1322      8700 IF (IOPT3.LE.0) GO TO 8900
1323
1324      C PRINT THE COMPOSITION OF THE NO-SUB PART SET FOR THIS PART-SUB
1325      C POLICY
1326      C
1327      DO 8800 I=1,NP2
1328      II=INS(I)
1329      IF (MOD(I-1,50).NE.0) GO TO 8800
1330      WRITE (6,10000) CASE
1331      WRITE (6,11100) KNTC
1332      WRITE (6,10200)
1333      WRITE (6,10300)
1334      8800 WRITE (6,11200) IT,AMSN(IT),ADESC(II),COST(II),FR(II),ZNRT(II),BCY
1335      * (II),DCY(II),BC(II),DC(II),STK(II)
1336      IND=2
1337
1338      C COMPUTE AND PRINT CAPABILITY ASSESSMENT RESULTS FOR "CURRENT INVENTORY"
1339      C WITH THE NEW PART-SUB POLICY
1340
1341      8900 CALL CCCAP (IND,LIMIT,CONVF,TTFH,KNTC,IP,FNC)
1342      KNTC=KNTC+1
1343
1344      C GO BACK AND PROCESS ANOTHER PART-SUB POLICY FOR USE IN CAPABILITY
1345      C ASSESSMENT
1346      C
1347      GO TO 7800
1348      9000 FORMAT (2F5.2,15,2F5.0)
1349      9100 FORMAT (16I5)
1350      9200 FORMAT (F5.0,F5.3,F5.0,F10.6)
1351      9300 FORMAT (1X,A16)
1352      9400 FORMAT (//)
1353      9500 FORMAT (2X,A15,F9.0,5X,F3.0,F5.0,5F3.0,I1,10X,15)
1354      9600 FORMAT (/,SF6.0,/)
1355      9700 FORMAT (I2)
1356      9800 FORMAT (A16)
1357      9900 FORMAT (10F10.0)
1358      10000 FORMAT (1H1;30X,"CASE= ",A16)
1359      10100 FORMAT (//,"ITEMS RANK ORDERED IN NORMAL INPUT ORDER")
1360      10200 FORMAT (/,,"PART",5X,"MSN",14X,"DESCRIPTION",7X,"COST OST FAIL",,
1361      * RT NRTS BCY DCY DRT BCN DCON QPA ESS CLASS INIT STK")
1362      10300 FORMAT (//)
1363      10400 FORMAT (9X,A16,2X,A16,F8.0,F3.0,F8.6,F5.2,3F5.0,2F5.2,1X,F3.0,I5,1
1364      * ,0X,I10)
1365      10500 FORMAT (1X,I4,4X,A16,2X,A16,F8.0,F3.0,F8.6,F5.2,3F5.0,2F5.2,1X,F3.
1366      * ,0,I5,1X,A8,F10.1)
1367      10600 FORMAT (/,,"TOTAL NR PARTS=",I4," NR USED=",I4)
1368      10700 FORMAT (1X,F14.0,F15.0,I5)
1369      10800 FORMAT (1X,F9.1,I5,5X,10I5)
1370      10900 FORMAT (//," FULL SUB ITEMS FOR POLICY",I3)
1371      11000 FORMAT (1X,I4,4X,A16,2X,A16,F8.0,3X,F8.6,F5.2,2F5.0,5X,2F5.2,1X,10
1372      * ,X," FULL SUB ",F10.0)
1373      11100 FORMAT (//," NO SUB ITEMS FOR POLICY",I3)
1374      11200 FORMAT (1X,I4,4X,A16,2X,A16,F8.0,3X,F8.6,F5.2,2F5.0,5X,2F5.2,1X,10
1375      * ,X," NO SUB ",F10.0)
1376      11300 FORMAT (16F5.1)
1377      11400 FORMAT (16F5.2)
1378      11500 FORMAT (/,104X," DEPLOYED")
1379      11600 FORMAT (" RANK PART",8X,"4SN",18X,"DESCRIPTION",13X,"COST",, CL
1380      * ,ASS",2X,"DSERV DUNSR WRSRV WRUNS DAY1 DAY2- TOT NC")
1381      11650 FORMAT (" RANK PART",8X,"MSN",18X,"DESCRIPTION",13X,"COST")
1382      11700 FORMAT (2I5,5X,A16,5X,A16,1X,F14.0,1X,A8,1X,5F6.0,2F7.0)
1383      11800 FORMAT (//," UNADJUSTED PARTS DEPLOYMENT BY DAY INTERVAL")
1384      11900 FORMAT (/,,-5,-10,-15,-20,-25,-30,-35,-40,-45,-50,-55,-60,-65,-70,-75,-80,-85,-90,-95,-
1385      * ,-100)
1386
1387      12000 FORMAT (", -105 -110 -115 -120")
1388      12100 FORMAT (I5,2X,A16,2X,A16)
1389      12200 FORMAT (1X,20F6.0)
1390      12300 FORMAT (//," ADJUSTED (FOR DEPOT STKS) PARTS DEPLOYED BY INTERVAL"
1391      * ,)
1392      12400 FORMAT (I5,2X,A16,2X,A16,3X,"WARNING* DEPOT UNSERV STK W/ DEP",,
1393      * ,0 TIME=0 (CHGEO 0 {) })

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1394 12500 FORMAT 1//,10X,"SCENARIO INPUT DATA SUMMARY")
1395 12600 FORMAT 1//,5X,"LOST OFFSET=",F6.1," DAYS DESIRED CONVERGECE=",F5
1396 +,3,/,3X,"MAX ITERATIONS=",I3,3X,"MAX ESSENTIALITY=",I3)
1397 12700 FORMAT 1/,5X," MAX FLY HRS/ACFT/DAY=",F5.1,4X,"ADD-ON COST LI=",M
1398 +IT=",F12.0,/,1X,"TOTAL (INIT INV=0) RQMT COST LIMIT=",F13.0)
1399 12800 FORMAT 1/,5X," COST OF CURRENT INVENTORY=",F14.0)
1400 12900 FORMAT 1/,13X,"CUM ACFT PROGRAM MIN REQ ACFT CUM ACFT")
1401 13000 FORMAT 7X,"DAY DEPLOYED FLY HRS AVAIL LOST",7X,"LOST")
1402 13100 FORMAT 15X,I5,F11.0,F10.0,F10.2,F8.1,F11.1)
1403 13200 FORMAT 1//,10X,"***** OPTIONS CHOSEN FOR THIS RUN *****")
1404 13300 FORMAT 1//,5X,"ISEL=",I3," ** ONLY THE TOTAL (INIT STK=0) ",, RQMT
1405 +TS ARE COMPUTED IN THIS RUN ")
1406 13400 FORMAT 1//,5X,"ISEL=",I3," ** ONLY THE RESIDUAL (INIT STK=CURR",
1407 +, INV) RQMTS ARE COMPUTED IN THIS RUN ")
1408 13500 FORMAT 1//,5X,"ISEL=",I3," ** BOTH THE TOTAL (INIT STK=0) AND "
1409 +RESIDUAL (INIT STK=CURR INV) RQMTS ARE IN THIS RUN ")
1410 13600 FORMAT 1//,5X,"NFS=",I3," ** FULL SUB SET IS CHOSEN ACCORDING",
1411 +TO A DEPOT REPAIR CYCLE EXCEEDING",F12.0," DAYS OR NRTS ",, "EXCEED
1412 +NG",F6.3,/,15X,"OR RETAIL REPAIR TIME EXCEEDING",F8.0," OR FAILU
1413 +RE RATE EXCEEDING",F9.6)
1414 13700 FORMAT 1//,5X,"NFS=",I3," ** FULL SUB SET IS SPECIFIED BY INPUT")
1415 13800 FORMAT 1//,5X,"IORD=",I3," ** COMPUTED RQMTS LISTS WILL BE IN ",,
1416 +ORDER OF DECREASING UNIT COST OF PART")
1417 13900 FORMAT 1//,5X,"IORD=",I3," ** COMPUTED RQMTS LISTS WILL BE IN ",,
1418 +ORDER OF DECREASING RQMT AMOUNT FOR PART")
1419 14000 FORMAT 1//,5X,"IOP1=",I3," ** ONLY ASSESSMENT CASES WILL BE ",,0
1420 +ONE IN THIS RUN")
1421 14100 FORMAT 1//,5X,"IOP1=",I3," ** BOTH ASSESSMENT AND RQMT CASES",,
1422 +WILL BE DONE IN THIS RUN")
1423 14200 FORMAT 1//,5X,"IOP2=",I3," ** THE FULL SUB PART SETS USED IN ",,
1424 +ASSESSMENT CASES WILL NOT BE PRINTED")
1425 14300 FORMAT 1//,5X,"IOP2=",I3," ** THE FULL SUB PART SETS USED IN ",,
1426 +ASSESSMENT CASES WILL BE PRINTED")
1427 14400 FORMAT 1//,5X,"IOP3=",I3," ** THE NO SUB PART SETS USED IN ",, AS
1428 +SESSMENT CASES WILL NOT BE PRINTED")
1429 14500 FORMAT 1//,5X,"IOP3=",I3," ** THE NO SUB PART SETS USED IN ",, AS
1430 +SESSMENT CASES WILL BE PRINTED")
1431 14600 FORMAT 1//,5X,"IOP4=",I3," ** THE UNCONSTR COST RQMTS LISTS",, W
1432 +ILL NOT BE PRINTED (BUT ARE COMPUTED)")
1433 14700 FORMAT 1//,5X,"IOP4=",I3," ** THE UNCONSTR COST RQMTS LISTS",, W
1434 +ILL BE PRINTED")
1435 14800 FORMAT 1//,5X,"IOP5=",I3," ** THE CUM RQMT BY DAY COST LISTS",,
1436 +WILL NOT BE PRINTED")
1437 14900 FORMAT 1//,5X,"IOP5=",I3," ** THE CUM RQMT BY DAY COST LISTS",,
1438 +WILL BE PRINTED")
1439 15000 FORMAT 1//,5X,"IPRT=",I3," ** THE SCENARIO INPUT DATA SUMMARY",,
1440 +WILL NOT BE PRINTED")
1441 15100 FORMAT 1//,5X,"IPRT=",I3," ** THE SCENARIO INPUT DATA SUMMARY",,
1442 +WILL BE PRINTED")
1443 15200 FORMAT 1//,5X,"IPRT1=",I3," ** THE FULL SUB AND NO SUB PART ",, S
1444 +ETS (FOR RQMT CASES) WILL NOT BE PRINTED",,13X,"NOR WILL ",,THE I
1445 +INPUT-ORDERED AND COST-ORDERED PARTS INPUT LISTS")
1446 15300 FORMAT 1//,5X,"IPRT1=",I3," ** THE FULL SUB AND NO SUB PART ",, S
1447 +ETS (FOR RQMT CASES) WILL BE PRINTED",,13X,"AS WILL ",,THE INPUT-
1448 +ORDRED AND COST-ORDERED PARTS INPUT LISTS")
1449 15400 FORMAT 1//,5X,"INT=",I3," ** THE PARTIAL SUB RQMT ALGORITHM",, W
1450 +LL TEST AT INTERVALS OF ",I3," (ALLOWABLE NMCS ACFT)
1451 15500 FORMAT 1//,5X,"ITEMS RANK ORDERED BY DECREASING PART COST")
1452 15600 FORMAT 13H1)
1453 15700 FORMAT 1//,20X,"*** CONSTRAINED COST SOLUTION EVALUATION",, REPORT
1454 +",",//)
1455 15800 FORMAT 11H1,/,10X,"THE UNCONSTR COST TOTAL RQMT SOLUTION IS",, AL
1456 +SO THE CONSTR COST TOTAL RQMT SOLUTION")
1457 15900 FORMAT 11H1,/,10X,"THE UNCONSTR COST RESIDUAL RQMT SOLUTION IS",, "
1458 + ALSO THE CONSTR COST RESIDUAL RQMT SOLUTION")
1459 16000 FORMAT 1//,10X,"ALL (NO SUB) PARTS ARE AFFORDABLE IN CONSTRAINED"
1460 +", COST SOLUTION")
1461 16100 FORMAT 1//,10X,"ALL FULL SUB PARTS ARE AFFORDABLE IN CONSTRAINED"
1462 +", COST SOLUTION")
1463 16200 FORMAT 1//,5X,F12.0,3X,"APPROXIMATED BY",F12.0," CUM FULL SUB",,
1464 +PART COST THRU DAY ",I4," IS USED TO BUY FULL SUB PARTS")
1465 16300 FORMAT 1//,10X,"CONSTR COST LIMIT=",F12.0,3X,"OF WHICH",F12.0,3X,"
1466 +CAN BE USED",,10X,"TO BUY (NO SUB) PARTS FROM THE UNCONSTR",,
1467 +", COST SOLUTION")
1468 16400 FORMAT 1//,10X,"NO FULL SUB PARTS ARE AFFORDABLE IN CONSTRAINED"
1469 +", COST SOLUTION")
1470 16500 FORMAT 1//,5X,"THE FIRST CONSTR COST SOL YIELDS AN AVG FRAC",, PGM
1471 + FLY HRS ACH=",F5.3)
1472 16600 FORMAT 1//,5X,"THE 2ND(SUSTNBLTY) CONSTR COST SOL YIELDS AN",, AVG
1473 + FRAC FH ACH=",F5.3)
1474 16700 END

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SUBROUTINE CCCAP

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123      SUBROUTINE CCCAP (IND,LIMIT,CONVF,TTFH,KNTC,IP,FNC)
124      C NAME: CCCAP          TYPE: SUBROUTINE
125      C PURPOSE: THE CCCAP (CONSTRAINED COST CAPABILITY ASSESSMENT) SUBROUTINE
126      C COMPUTES FLEET CAPABILITY ASSESSMENT (AVG AVAILABILITY, FRACTION FLYING
127      C PROGRAM ACHIEVED, PGM FLYING HRS / ACFT/DAY ) BASED ON THE CONSTRAINED COST
128      C SOLUTION BEING STOCKED IN THE WAR RESERVE
129      C CALLED BY: MAIN PROGRAM
130      C CALLS:
131          -FUNCTION SR: COMPUTES CUMULATIVE NET DEMAND THRU A SPECIFIED DAY
132          FOR A SPECIFIED PART
133      C FILES USED : INPUT - NONE
134          OUTPUT - UNIT 6 (PRINT)
135
136      C ARGUMENTS
137
138      C      NAME          TYPE          DESCRIPTION
139
140      C      IND           FIXED         INDICATOR OF WHETHER TOTAL (INIT STK=0) OR
141      C      RESIDUAL (INIT STK='CURRENT INVENTORY') REQMTS
142      C      ARE BEING PROCESSED. IND=1 INDICATES TOTAL
143      C      REQMTS. IND=2 INDICATES RESIDUAL REQMTS.
144
145      C      LIMIT          FIXED         THE MAXIMUM NUMBER OF ITERATIONS (PER DAY)
146      C      WHICH THE CONSTRAINED COST CAPABILITY
147      C      ASSESSMENT ALGORITHM (SUBROUTINE CCCAP)
148      C      WILL PERFORM BEFORE IT TERMINATES
149
150      C      CONVF          REAL          THE CONVERGENCE THRESHOLD (INPUT) USED IN THE
151      C      CAPABILITY ASSESSMENT WITH CONSTRAINED COST OR
152      C      WITH 'CURRENT INVENTORY'
153
154      C      TTFH           REAL          TOTAL FLYING HOURS IN THE FULL SCENARIO
155
156      C      KNTC           FIXED         THE PARTIAL-SUB POLICY BEING PROCESSED. KNTC=1
157      C      IS THE POLICY USED IN REQMTS CALCULATIONS AND
158      C      IN THE 1ST 'CURRENT INVENTORY' CAPABILITY
159      C      ASSESSMENT. KNTC=2,3,.. ARE ADDITIONAL POLICIES
160      C      (INPUT) USED ONLY IN CAPABILITY ASSESSMENTS
161      C      OF CURRENT INVENTORY
162
163      C      IP              FIXED         INDICATOR TELLING THE CONST COST CAPABILITY
164      C      ASSESSMENT ROUTINE (CCCAP) WHETHER TO PRINT THE
165      C      AMOUNT OF SOLUTION REQMT. THIS IS SET BY THE
166      C      MAIN PROGRAM.
167
168      C      FNC             REAL          FRACTION OF FLEET FLYING HR PROGRAM (FULL WAR)
169      C      WHICH CAN BE ACHIEVED WITH THE CONST COST
170      C      SOLUTION INVENTORY OR WITH 'CURRENT INVENTORY'
171
172      C LOCAL ARRAYS
173
174      C      NAME          DIMENSION  TYPE          DESCRIPTION
175
176      C      DMDT(J)        300        REAL          WORKING VARIABLE USED IN THE CALC OF NET DEMAND
177      C      FOR PART J ON DAY I DURING ITERATIONS (TO COMPUTE
178      C      ACHIEVED FLYING HRS) FOR EACH DAY
179
180      C      FHNC(I)        120        REAL          NUMBER OF ACHIEVED PROGRAM FLYING HRS ON DAY I
181      C      FHNZ(I)        120        REAL          FRACTION OF PROGRAM FLYING HRS WHICH ARE ACHIEVED
182          ON DAY I
183
184      C COMMON BLOCK (UNLABELED) ENTRIES
185
186      C      NAME          DIMENSION  TYPE          DESCRIPTION
187
188      C      AC(I)          120        REAL          NR ACFT DEPLOYED ON DAY I

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82
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 84
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 86
 87 C ALLOW(I) 120 REAL MAXIMUM ALLOWABLE NMCS AC ON DAY I WHICH
 88 C WILL STILL ALLOW ACHIEVEMENT OF CASE OBJECTIVE
 89 C (IFLYING HOUR AND AVAILABILITY) ON DAY I
 90 C ASURV(I) 120 REAL NR AC SURVIVING (NOT ATTRITTED) ON DAY I
 91 C AVAVG(I) 6 REAL AVAVG(I)=AVG ACFT AVAIL ,FROM CAPABILITY
 92 C ASSESSMENT,BASED ON STOCKAGE OF EITHER
 93 C CURR INV OR I CURR INV + COMPUTED ADD-ON
 94 C REQMTS SOLUTION
 95
 96
 97
 98
 99
 100
 101
 102
 103 C CASE CHAR CASE ID
 104 C CL 1 REAL THE COST LIMIT (AS SPECIFIED BY INPUT) USED
 105 C IN THE CONSTRAINED COST REQMTS CASE.
 106
 107 C DMD(J) 300 REAL WORKING VARIABLE USED IN CALCULATION OF
 108 C NET DEMAND(SRC(I,J,...)) FOR PART J ON DAY I
 109 C DURING CAPABILITY ASSESSMENT.
 110 C WHEN (CUM)NET DMD THRU DAY I IS BEING
 111 C CALCULATED,DMD(I,J) IS (CUM) NET DMD THRU THE
 112 C PREVIOUS DAY,BASED ON AN INITIAL STK=0.
 113
 114 C DOD(I,J) 300 REAL ARRAY STORING THE ATTRIBUTE TO BE SORTED ON
 115 C IN SUBROUTINE MCAC. IN MAIN PGM,THIS HAS PART
 116 C UNIT COST FOR PART J. IN SUBROUTINES CLLIST &
 117 C UCRAPS,THIS HAS THE AMOUNT OF THE SOLUTION
 118 C REQMT FOR PART J.
 119
 120 C FMC(I) 120 REAL DURING THE CONSTR COST CAPABILITY ASSESSMENT
 121 C (SUBROUTINE MCAPS) THIS IS THE INITIAL ESTIMATE
 122 C FOR FLYING HRS ACHIEVED ON DAY I WHEN
 123 C EITHER CURR INV OR (CURR INV + COMPUTED
 124 C CONSTRAINED COST ADD-ON REQMT) IS STOCKED.
 125 C THIS IS RECURSIVELY COMPUTED.
 126
 127 C FHM REAL MAXIMUM FLYING HRS PER ACFT PER DAY(INPUT)
 128 C FHPAPO(I,N,I) 3,120 REAL FHPAPO(I,N,I)=FLYING HRS PER AVAILABLE ACFT PER
 129 C FOR DAY I UNDER THE SPECIFIED REPLACEMENT
 130 C POLICY BASED ON STOCKING (CURRENT INV +
 131 C THE UNCONSTRAINED COST SOLUTION)
 132
 133 C FHPAPO(I,J,I) 3,120 REAL FHPAPO(I,J,I)=FLYING HRS PER AVAILABLE ACFT PER
 134 C FOR DAY I UNDER THE SPECIFIED REPLACEMENT
 135 C POLICY STOCKING EITHER CURRENT INVENTORY OR
 136 C (CURR INV + THE CONSTRAINED COST SOLUTION)
 137
 138 C FHR(I) 120 REAL FLEET PROGRAM FLYING HOURS REQUIRED ON DAY I
 139 C (ACCORDING TO THE INPUT FLYING HR PROGRAM)
 140
 141 C ICOST 1 FIXED INDICATOR WHICH TELLS SUBROUTINE UCRAPS WHETHER
 142 C TO PRINT THE PARTS REQMTS LIST (0=DO 1=DON'T).
 143 C REQMTS LIST IS NOT PRINTED DURING CONSTRAINED
 144 C COST REQMT CALCULATIONS.
 145
 146 C IFS(J) 300 FIXED ARRAY STORING THE PARCOM PART NUMBERS OF THE
 147 C PARTS IN THE FULL-SUB PART SET.
 148
 149 C INS(J) 300 FIXED ARRAY STORING THE PARCOM PART NUMBERS OF THE
 150 C PARTS IN THE NO-SUB PART SET.
 151
 152 C NP 1 FIXED NR OF PART TYPES PROCESSED IN RUN. (THIS
 153 C EXCLUDES PART TYPES WITH ESSENTIALITY CODE
 154 C OLE. IESS OR WITH A ZERO FAILURE RATE)
 155
 156 C NP1 1 FIXED TOTAL NUMBER OF "PART NUMBERS" IN THE FULL-SUB
 157 C PART SET
 158
 159 C VP2 1 FIXED TOTAL NUMBER OF "PART NUMBERS" IN THE NO-SUB
 160 C PART SET

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164
156 C NW : FIXED LENGTH(DAY*) OF SCENARIO
157 C PTDEP(J,K) 700,24 REAL TOTAL AMOUNT OF INITIAL STOCK FOR PART J
158 C RECEIVED AT THEATER (EXCLUDING IN-PLACE STOCK)
159 C BETWEEN DAY 54K-# AND DAY 54K
160 C
161 C CPA(J) 300 REAL THE 'QUANTITY PER APPLICATION' FOR PART J.
162 C I.E., THE STANDARD NUMBER OF ITEMS OF PART J
163 C INSTALLED ON EACH OPERATIONAL ACFT
164 C
165 C RNC(I) 170 REAL AC AVAILABILITY IMPLIED BY STOCKAGE OF
166 C (COMPUTED RQMT + CURRENT INVENTORY) OR BY
167 C STOCKAGE OF ONLY THE CURRENT INVENTORY
168 C
169 C RNCS(J) 300 REAL THE SUM OF THE COMPUTED RQMT FOR PART J AND
170 C THE CUM INITIAL STOCK ISSUED/DEPLOYED THRU
171 C DAY I
172 C
173 C SUMB(I) 170 REAL TOTAL STOCKOUTS OVER ALL PARTS IN THE NO-SUB
174 C PART SET, AS CALCULATED DAY I DURING
175 C CAPABILITY ASSESSMENT
176 C
177 C COMMON
178 C   AC(120), ACL, ADESC(300), ALLOW1(120),
179 C   ALLOW2(120), AMS(1300), ASURV(120), AVAVG(6),
180 C   AVMT(120), BCY(300), BF(300), CASE,
181 C   CDMDA(300), CF(120), CL, CMINT,
182 C   CNCS(120), COS(1300), CPNCS(300), DCOST1(300),
183 C   DCOST2(120), DCY(300), DF(300), DM(300),
184 C   DOD(120), FHA(120), FHN, FHPAPD(3,120),
185 C   FHR(120), ICO(120), IDC(120), IFHC(120),
186 C   IFS(120), IHS(120), INS(300), INT,
187 C   IPT(120), ITC(1300), IPO(300), ISHORT,
188 C   NP, NPI, NP2, NW,
189 C   PTDEP(300,24), CPA(300), RNC(120),
190 C   SM(120,130), SRM(120,130), STK(300), RNCS(300),
191 C   TRNCS(300), TST(1300), TSUMB, SUMB(120),
192 C
193 C DIMENSION
194 C   DM(120,120), FHN(1120), FHN2(120)
195 C   CHARACTER(16), ADESC, ADSC, AMSN, CASE
196 C   BMAX(120),
197 C   AVAVG(120),
198 C   AVAVG(130),
199 C   TFHNC(120),
200 C   TSURV(120),
201 C   TNCD(120),
202 C   DO 100 I=1,NW
203 C   TSURV=TSURV+ASURV(I)
204 C   SUMB(I)=0
205 C   DO 100 K=1,3
206 C   100 FHPAPD(K,120),
207 C   DO 200 J=1,NP
208 C   200 U(0)(J)=0,
209 C   DM(120,120)=0,
210 C   200 DM(120,120)=0,
211 C   XX=ASURV(I)
212 C   TAV=J,
213 C
214 C THRU STMT 120 PROCESS EACH DAY
215 C
216 C   DO 120 I=1,NW
217 C   IA=II-19/5+1
218 C
219 C SET RNCS=EQMT + ISSUED INITIAL STOCK THRU DAY I
220 C
221 C   DO 300 J=1,NP
222 C   300 RNCS(I)=RNCS(I)+ (IND-1)*PTDEP(I,J)/5,
223 C
224 C CALCULATE INITIAL ESTIMATED ACFT AVAILABILITY THIS DAY AS THOSE AVAILABLE
225 C YESTERDAY+NEWLY DEPLOYED ACFT, THEN CALCULATE ESTIMATED FLYING HOURS
226 C ACHIEVED BASED ON THE ESTIMATED ACFT AVAILABLE.
227 C
228 C   IF (I.GT.1) XX=RNC(I-1)*ASURV(I-1)*AC(I)-AC(I-1)
229 C   FHA(I)=AMIN1(XXX*FHN, FHR(I))
230 C   INDEXD
231 C   IF INDEXD.EQ.1 GO TO 400
232 C
233 C THRU STMT 500 DO MMAS ACFT ASSESSMENT FOR THE NO-SUB SET.
234 C 500 INDEXD=0
235 C   INDEXD=1
236 C   IF INDEXD.EQ.1 GO TO 400
237 C
238 C   INDEXD=0
239 C   INDEXD=1
240 C   INDEXD=2
241 C   INDEXD=3
242 C   INDEXD=4
243 C   INDEXD=5
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803 C   INDEXD=565
804 C   INDEXD=566
805 C   INDEXD=567
806 C   INDEXD=568
807 C   INDEXD=569
808 C   INDEXD=570
809 C   INDEXD=571
810 C   INDEXD=572
811 C   INDEXD=573
812 C   INDEXD=574
813 C   INDEXD=575
814 C   INDEXD=576
815 C   INDEXD=577
816 C   INDEXD=578
817 C   INDEXD=579
818 C   INDEXD=580
819 C   INDEXD=581
820 C   INDEXD=582
821 C   INDEXD=583
822 C   INDEXD=584
823 C   INDEXD=585
824 C   INDEXD=586
825 C   INDEXD=587
826 C   INDEXD=588
827 C   INDEXD=589
828 C   INDEXD=590
829 C   INDEXD=591
830 C   INDEXD=592
831 C   INDEXD=593
832 C   INDEXD=594
833 C   INDEXD=595
834 C   INDEXD=596
835 C   INDEXD=597
836 C   INDEXD=598
837 C   INDEXD=599
838 C   INDEXD=600
839 C   INDEXD=601
840 C   INDEXD=602
841 C   INDEXD=603
842 C   INDEXD=604
843 C   INDEXD=605
844 C   INDEXD=606
845 C   INDEXD=607
846 C   INDEXD=608
847 C   INDEXD=609
848 C   INDEXD=610
849 C   INDEXD=611
850 C   INDEXD=612
851 C   INDEXD=613
852 C   INDEXD=614
853 C   INDEXD=615
854 C   INDEXD=616
855 C   INDEXD=617
856 C   INDEXD=618
857 C   INDEXD=619
858 C   INDEXD=620
859 C   INDEXD=621
860 C   INDEXD=622
861 C   INDEXD=623
862 C   INDEXD=624
863 C   INDEXD=625
864 C   INDEXD=626
865 C   INDEXD=627
866 C   INDEXD=628
867 C   INDEXD=629
868 C   INDEXD=630
869 C   INDEXD=631
870 C   INDEXD=632
871 C   INDEXD=633
872 C   INDEXD=634
873 C   INDEXD=635
874 C   INDEXD=636
875 C   INDEXD=637
876 C   INDEXD=638
877 C   INDEXD=639
878 C   INDEXD=640
879 C   INDEXD=641
880 C   INDEXD=642
881 C   INDEXD=643
882 C   INDEXD=644
883 C   INDEXD=645
884 C   INDEXD=646
885 C   INDEXD=647
886 C   INDEXD=648
887 C   INDEXD=649
888 C   INDEXD=650
889 C   INDEXD=651
890 C   INDEXD=652
891 C   INDEXD=653
892 C   INDEXD=654
893 C   INDEXD=655
894 C   INDEXD=656
895 C   INDEXD=657
896 C   INDEXD=658
897 C   INDEXD=659
898 C   INDEXD=660
899 C   INDEXD=661
900 C   INDEXD=662
901 C   INDEXD=663
902 C   INDEXD=664
903 C   INDEXD=665
904 C   INDEXD=666
905 C   INDEXD=667
906 C   INDEXD=668
907 C   INDEXD=669
908 C   INDEXD=670
909 C   INDEXD=671
910 C   INDEXD=672
911 C   INDEXD=673
912 C   INDEXD=674
913 C   INDEXD=675
914 C   INDEXD=676
915 C   INDEXD=677
916 C   INDEXD=678
917 C   INDEXD=679
918 C   INDEXD=680
919 C   INDEXD=681
920 C   INDEXD=682
921 C   INDEXD=683
922 C   INDEXD=684
923 C   INDEXD=685
924 C   INDEXD=686
925 C   INDEXD=687
926 C   INDEXD=688
927 C   INDEXD=689
928 C   INDEXD=690
929 C   INDEXD=691
930 C   INDEXD=692
931 C   INDEXD=693
932 C   INDEXD=694
933 C   INDEXD=695
934 C   INDEXD=696
935 C   INDEXD=697
936 C   INDEXD=698
937 C   INDEXD=699
938 C   INDEXD=700
939 C   INDEXD=701
940 C   INDEXD=702
941 C   INDEXD=703
942 C   INDEXD=704
943 C   INDEXD=705
944 C   INDEXD=706
945 C   INDEXD=707
946 C   INDEXD=708
947 C   INDEXD=709
948 C   INDEXD=710
949 C   INDEXD=711
950 C   INDEXD=712
951 C   INDEXD=713
952 C   INDEXD=714
953 C   INDEXD=715
954 C   INDEXD=716
955 C   INDEXD=717
956 C   INDEXD=718
957 C   INDEXD=719
958 C   INDEXD=720
959 C   INDEXD=721
960 C   INDEXD=722
961 C   INDEXD=723
962 C   INDEXD=724
963 C   INDEXD=725
964 C   INDEXD=726
965 C   INDEXD=727
966 C   INDEXD=728
967 C   INDEXD=729
968 C   INDEXD=730
969 C   INDEXD=731
970 C   INDEXD=732
971 C   INDEXD=733
972 C   INDEXD=734
973 C   INDEXD=735
974 C   INDEXD=736
975 C   INDEXD=737
976 C   INDEXD=738
977 C   INDEXD=739
978 C   INDEXD=740
979 C   INDEXD=741
980 C   INDEXD=742
981 C   INDEXD=743
982 C   INDEXD=744
983 C   INDEXD=745
984 C   INDEXD=746
985 C   INDEXD=747
986 C   INDEXD=748
987 C   INDEXD=749
988 C   INDEXD=750
989 C   INDEXD=751
990 C   INDEXD=752
991 C   INDEXD=753
992 C   INDEXD=754
993 C   INDEXD=755
994 C   INDEXD=756
995 C   INDEXD=757
996 C   INDEXD=758
997 C   INDEXD=759
998 C   INDEXD=760
999 C   INDEXD=761
1000 C   INDEXD=762
1001 C   INDEXD=763
1002 C   INDEXD=764
1003 C   INDEXD=765
1004 C   INDEXD=766
1005 C   INDEXD=767
1006 C   INDEXD=768
1007 C   INDEXD=769
1008 C   INDEXD=770
1009 C   INDEXD=771
1010 C   INDEXD=772
1011 C   INDEXD=773
1012 C   INDEXD=774
1013 C   INDEXD=775
1014 C   INDEXD=776
1015 C   INDEXD=777
1016 C   INDEXD=778
1017 C   INDEXD=779
1018 C   INDEXD=780
1019 C   INDEXD=781
1020 C   INDEXD=782
1021 C   INDEXD=783
1022 C   INDEXD=784
1023 C   INDEXD=785
1024 C   INDEXD=786
1025 C   INDEXD=787
1026 C   INDEXD=788
1027 C   INDEXD=789
1028 C   INDEXD=790
1029 C   INDEXD=791
1030 C   INDEXD=792
1031 C   INDEXD=793
1032 C   INDEXD=794
1033 C   INDEXD=795
1034 C   INDEXD=796
1035 C   INDEXD=797
1036 C   INDEXD=798
1037 C   INDEXD=799
1038 C   INDEXD=800
1039 C   INDEXD=801
1040 C   INDEXD=802
1041 C   INDEXD=803
1042 C   INDEXD=804
1043 C   INDEXD=805
1044 C   INDEXD=806
1045 C   INDEXD=807
1046 C   INDEXD=808
1047 C   INDEXD=809
1048 C   INDEXD=810
1049 C   INDEXD=811
1050 C   INDEXD=812
1051 C   INDEXD=813
1052 C   INDEXD=814
1053 C   INDEXD=815
1054 C   INDEXD=816
1055 C   INDEXD=817
1056 C   INDEXD=818
1057 C   INDEXD=819
1058 C   INDEXD=820
1059 C   INDEXD=821
1060 C   INDEX
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246      C
247      400  DO 500 K=1,NP2
248          II=INS(K)
249          XX=DMDT(II)
250          DMDT(II)=SR(II,II,XX)
251          ZP=DMDT(II)-RNCS(II)
252      500  SUMB(II)=SUMB(II)+AMAX1(0.,ZP)
253      600  IF (NP1.EQ.0) GO TO 800
254
255      C THRU STMT 700 DO NMCS ACFT ASSESSMENT FOR THE FULL-SUB SET.
256      C BOFCS=NET DEMAND (BACKORDERS) FROM PART K/QPA = NMCS ACFT FROM THIS
257      C FULL-SUB PART. BMAX = TOTAL NMCS ACFT FROM ALL FULL-SUB PARTS PROCESSED
258      C
259          BMAX=0.
260          DO 700 K=1,NP1
261              II=IFS(K)
262              XX=DMDT(II)
263              DMDT(II)=SR(II,II,XX)
264              BOFCS=(DMDT(II)-RNCS(II))/QPA(II)
265              IF (BOFCS.LE.0.) BOFCS=0.
266              BMAX=AMAX1(BMAX,BOFCS)
267      700  CONTINUE
268
269      C CALCULATE AUNCs=TOTAL AVAILABLE (NON-NMCS) ACFT FROM ALL PARTS. THEN
270      C CONVERT IT TO A FRACTION AVAILABLE.
271      C
272      800  AUNCs=AMAX1(0.,ASURV(II)-SUMB(II)-BMAX)
273          FHNC(II)=AMIN1(FHR(II),AUNCs*FHR)
274          FHAPD(3,II)=AMIN1(FHM,FHR(II)/(AUNCs+.01))
275          FMNZ(II)=FHNC(II)/(FHR(II)+.000001)
276          AUNCs=AUNCs/(ASURV(II)+.00001)
277
278      C CHECK WHETHER ITERATIONS SHOULD STOP. COMPUTE Z=DIFFERENCE BETWEEN
279      C INITIAL EST FLYING HRS AND CALCULATED FLYING HRS ACHIEVED CHECK
280      C IF Z/(AVG DAILY PGM FLYING HRS) .LT. CONVF(INPUT). IF SO
281      C CONVERGENCE IS CLOSE ENOUGH TO TERMINATE ITERATIONS. ALSO CHECK
282      C IF ITERATIONS IS .GE. LIMIT(INPUT). IF SO, STOP ITERATIONS.
283      C
284          Z=ABS(FHNC(II)-FHA(II))
285          INDX=INDX+1
286          IF (INDX.GE.LIMIT.OR.(Z/(TTFH+1.)).LE.(CONVF/NW).OR.INDX.GT.30)
287              * GO TO 1000
288
289      C CALC NEW EST FLYING HRS ACHIEVED(USED IN SUBROUTINE SR TO CALC NET DEMAND
290      C
291          FHA(II)=.5*(FHA(II)+FHNC(II))
292          BMAX=0.
293          SUMB(II)=0.
294
295      C RESET CUM DEMAND THRU LAST DAY WHEN A NEW ITERATION IS TO RESUME
296      C
297          DO 900 J=1,NP
298              900  DMDT(J)=DMDT(J)
299              60 TO 400
300              1000  TFHNC=TFHNC+FHNC(II)
301              60 1100  J=1,NP
302              1100  DMD(J)=DMDT(J)
303
304      C CALC THE AVG DAILY DISCREPANCY(Z) BETWEEN THE STARTING AND ENDING DAILY
305      C FLYING HR ESTIMATES, EXPRESSED AS A % OF AVG DAILY FLYING PGM. ACCUMULATE
306      C THE AVG FRACTION OF THE FLYING PGM THAT IS ACHIEVED(FNC). CALC AVG
307      C ACFT AVAILABILITY(AX) REQUIRED TO ACHIEVE THE DAY'S FLYING HR AND AVAIL
308      C OBJECTIVES
309      C
310          TNCD=TNCD+Z
311          RNC(II)=AUNCs
312          TAV=TAV+RNC(II)*ASURV(II)
313
314      1200  CONTINUE
315          Z=100.*TNCD/(TFHNC+.001)
316          FNC=TFHNC/TTFH
317          IF (IP.EQ.0) RETURN
318
319      C PRINT THE CAPABILITY ASSESSMENT RESULTS ON A DAILY BASIS, W/AVERAGES
320      C
321          DO 1400 I=1,NW
322              SUMB(II)=SUMB(II)/(ASURV(II)+.00001)
323              AX=1.-(ALLOW8(I)/(ASURV(II)+.000001))
324              IF (MOD(I-1,50).NE.0) GO TO 1300
325              WRITE (16,1500) CASE
326              IF ((ICOST.EQ.1.AND.IND.EQ.1) WRITE (16,1600)
327              IF ((ICOST.EQ.1.AND.IND.EQ.2) WRITE (16,1700)
328              IF ((ICOST.EQ.0) WRITE (16,1803) MNTC

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328      IF (ICOST.EQ.1) WRITE (6,1903) CL
329      WRITE (6,2000)
330
331      C CALC AVG ACFT AVAILABILITY(AVAVG(1)),WEIGHTED BY DAILY NR OF ACFT SURVIVING.
332      C CALC AVG ACHIEVED PGM FLYING HRS/ACFT/DAY(AVAVG(3)),WEIGHTED BY DAILY NR
333      C OF ACFT AVAILABLE.
334      C
335      WRITE (6,2100) Z
336      WRITE (6,2000)
337      WRITE (6,2200)
338      WRITE (6,2300)
339      WRITE (6,2400)
340      WRITE (6,2000)
341      1300  AVAVG(1)=AVAVG(1)+RNC(I)*ASURV(I)/TSURV
342          AVAVG(3)=AVAVG(3)+FHPAPD(3,I)*RNC(I)*ASURV(I)/TAV
343      1400  WRITE (6,2500) I,RNC(I),AX,I,FHNZ(I),FHPAPD(3,I)
344      WRITE (6,2600) AVAVG(1),AVAVG(2),FNC,AVAVG(3)
345      RETURN
346      1500  FORMAT (1H1,30X,*CASE = *A16)
347      1600  FORMAT (/,1X,*" FORCE CAPABILITY WITH CONSTR COST TOTAL ",*RQMT
348          *" SOLUTION STOCKED AT RETAIL",/,*,*" NO POST D-DAY PARTS DEPLOYED
349          +*) *")
350      1700  FORMAT (/,1X,*" FORCE CAPABILITY WITH CONSTR COST RESIDUAL ",*R
351          *"QMT SOLUTION STOCKED & DEPLOYED **")
352      1800  FORMAT (/,1X,*" FORCE CAPABILITY GIVEN THE CURRENT",* INV",*EN
353          *"TORY STOCKED & DEPLOYED FOR POLICY",*I3,* **")
354      1900  FORMAT (/,1X,*"COST LIMIT OF",*F12.0)
355      2000  FORMAT (/,1X,*" TOTAL FLY HRS CONVERGED TO:",* WITHIN",*F7.3,* PERCENT")
356      2100  FORMAT (9X,*" ACHIEVED",*22X,*"ACHIEVED",*}
357      2200  FORMAT (11X,*" ACFT",*22X,*"FRACTION",*4X,*"FLY HRS/AC")
358      2300  FORMAT (6X,*"DAY",*5X,*"AVAIL",*3X,*"REQ AVAIL",*6X,*"DAY",*3X,*"FH PGM",*1X,
359          *"/DAY")
360      2400  FORMAT (5X,*I",*5X,*F5.3,*7X,*F5.3,*5X,*I",*4X,*F5.3,*6X,*F8.1)
361      2500  FORMAT (/,*,*AVERAGES",*4X,*F5.3,*7X,*F5.3,*13X,*F5.3,*10X,*F5.1)
362      2600  FORMAT (/,*,*)
363      END

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CAA-D-85-3

(NOT USED)

SUBROUTINE CCLIST

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1          SUBROUTINE CCLIST (IG, IORD, IND)
2          C NAME: CCLIST      TYPE: SUBROUTINE
3          C PURPOSE: THE CCLIST (CONSTRAINED COST REQUIREMENTS LIST) SUBROUTINE
4          C PRINTS THE CONSTRAINED COST REQUIREMENTS SOLUTION.
5          C CALLED BY: MAIN PROGRAM
6          C CALLS
7          C     -SUBROUTINE MAXC: ORDERS THE LIST OF REQUIREMENTS TO BE PRINTED
8          C             OUTPUT - UNIT 6 (PRINT)
9          C FILES USED :OUTPUT - UNIT 6 (PRINT)
10         C             INPUT - NONE
11         C LOCAL ARRAYS : NONE
12
13         C ARGUMENTS
14
15         C     NAME          TYPE          DESCRIPTION
16
17         C     IG            FIXED         INDICATOR TO SUBROUTINE CCLIST OF WHETHER CONSTRAINED COST ALGORITHM 1 (IG=1) OR CONSTRAINED COST ALGORITHM 2 (IG=2) WAS USED TO DETERMINE THE FINAL CONSTRAINED COST SOLUTION
18
19         C     IND           FIXED         INDICATOR OF WHETHER TOTAL (INIT SYK=0) OR RESIDUAL (INIT SYK='CURRENT INVENTORY') REQUANTS ARE BEING PROCESSED. IND=1 INDICATES TOTAL REQUANTS. IND=2 INDICATES RESIDUAL REQUANTS.
20
21         C     IORD          FIXED         RUN OPTION (INPUT). IF IORD .LE. 0, THEN THE SOLUTION REQUANTS LISTS WILL BE ORDERED ACCORDING TO DECREASING UNIT COST OF PART. IF OPT3 .GT. 0 THE REQUANTS LISTS ARE ORDERED BY (DECREASING) AMOUNT OF SOLUTION REQUANT.
22
23
24         C COMMON BLOCK (UNLABLED) ENTRIES
25
26         C     NAME          DIMENSION   TYPE          DESCRIPTION
27
28         C     ACL            1  REAL        THE AMOUNT(S) OF SUSTAINABILITY DOLLARS BASED ON THE 'CUM REQMT COST THRU DAY N' TABLES, WHICH IS THE CLOSEST APPROXIMATION TO THE INPUT COST LIMIT FOR THE CONSTRAINED COST CASE
29
30         C     ADESCI(J)      300  CHAR       16 CHAR DESCRIPTION OF SPARE PART J
31
32         C     AMSN(J)        300  CHAR       IDENTIFICATION NR(NSN) OF SPARE PART J
33
34         C     CASE           CHAR         CASE ID
35
36         C     CL             1  REAL        THE COST LIMIT (AS SPECIFIED BY INPUT) USED IN THE CONSTRAINED COST REQUANTS CASE.
37
38         C     CNCSI(J)      300  REAL       TOTAL COST OF REQUANT FOR PART J USING THE SPECIFIED PART REPLACEMENT POLICY.
39
40         C     COSTI(J)      300  REAL       COST OF A SINGLE ITEM OF PART J.: THIS IS ALSO DENOTED AS 'PART UNIT COST'.
41
42
43
44
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C CCG(J)      3FF  REAL   ARRAY STORED THE ATTRIBUTE TO BE SORTED ON
C                                         IN SUBROUTINE MAXC. IN SUBROUTINE CLIST
C                                         THIS HAS THE AMOUNT OF THE SOLUTION REQMT
C                                         FOR PART J.

C IC001(IND)    2  FIXED  STORES ,FOR EITHER TOTAL(IND=1) OR RESIDUAL
C                                         (IND=2), THE LATEST DAY FROM THE * CUM COST
C                                         REQMT THRU DAY N° TABLE (FROM THE UNCONSTRAINED
C                                         COST CASE) FOR WHICH ASSOCIATED CUM COST
C                                         IS LESS THAN OR = THE INPUT-SPECIFIED COST
C                                         LIMIT USED IN THE CONSTRAINED COST CASE.

C IR01(J)      300  FIXED  ARRAY CONTAINING PART NUMBERS ORDERED ACC TO
C                                         DECREASING PART UNIT COST FOR ASSOCIATED PART.

C IR02(J)      300  FIXED  ARRAY CONTAINING PART NUMBERS ORDERED ACC TO
C                                         DECREASING SOLUTION REQMT AMOUNT FOR ASSOCIATED PART.

C NP             1  FIXED  NR OF PART TYPES PROCESSED IN RUN. (THIS
C                                         EXCLUDES PART TYPES WITH ESSENTIALITY CODE
C                                         .LE. IESS OR WITH A ZERO FAILURE RATE)

C RNCS(J)      3FF  REAL   THE CALCULATED REQMT FOR PART J

C
C COMMON
C   AC(120),      ACL,      ADESC(300),      ALLOW1(120),
C   ALLOW1(120),   AMS(300),   ASURV(120),   AVERAGE(),
C   AVG(120),      BCF(300),   BF(300),      CASE,
C   CDMOA(300),   CF(300),   CL,          CHINT,
C   CNCS(120),     COS(120),   CPNCS(300),   DCOST1(300),
C   DCOSTF(120),   DCY(300),   DF(300),      DM0(300),
C   DGD(120),      DHA(120),   FHM,          FHPAPD(3,120),
C   FHR(120),      DCOST,     IDCC(2),      IFHCF(120),
C   IF5(300),      DMSL,     INS(300),      INT,
C   IPT(120),      IR0(120),   IPO(300),     ISHORT,
C   NP,           NP1,      NP2(120),     NW,
C   PTD0EP(1300,24), QPA(300),   RNCS(120),   RNCS(300),
C   SM(120,100),   SRMAX(300),  STK(300),   SUMB(120),
C   TRNCS(300),   TSTM(300),   TSUMB
C
C CHARACTER#16
C   ADESC,
C   IF (IORD.LE.0) GO TO 30      AMSN,      CASE
C
C IF IODD .GT. ORDER THE REQMTS LIST BY DECREASING AMOUNT OF REQMT
C   DO 100 I=1,NP
C     IPO(I)
C   100 D001(IRNCS(I))
C   DUMMY=NP
C   DO 200 K=1,NP
C     CALL MAXC (DUMMY,NO LT)
C     IPO(K)=OUT
C     I=IRO(I)
C   200 D001(I)=-
C
C PRINT THE CONSTRAINED COST REQMTS SOLUTION
C   3 C DO 500 I=1,NP
C     I=IRO(I)
C     IF (IORD.LE.0) I=IIR(I)
C     IF (MOUT(I-1,57).NE.0) GO TO 400
C     WRITE (6,600) CASE
C     IF (IND.EQ.0,1) WRITE (6,700)
C     IF (IND.EQ.0,2) WRITE (6,800)
C     IF (IND.EQ.0,3) WRITE (6,900)
C     IF (IND.EQ.0,4) WRITE (6,1000) CL,SCL
C     IF (IND.EQ.0,5) WRITE (6,1100) CL,ACL,DC001(IND)
C     WRITE (6,900)
C     WRITE (6,1200)
C     WRITE (6,900)
C   400  CNCS(I)=COST(I)*RNCS(I)
C     TCE=100.*CNCS(I)/(ACL*DC001(1))
C     SCL=WRITE (6,1400) I,I,AMSN(I),ADESC(I),RNCS(I),CNCS(I),TC
C     RETURN
C   500 FORMAT (1H1,2F8.0,CASE= *,A16)

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164      700 FORMAT (/,23X, " TOTAL (INIT STK=0) STK RQMTS ")
165      800 FORMAT (/,30X, "RESIDUAL (INIT STK=CURR STK) STK RQMTS ")
166      900 FORMAT (/)
167      1000 FORMAT (//,10X, "COST LIMIT OF", F12.0, " APPROXIMATED BY", F12.0, //,
168      *10X, "USING A COMBINED (CHEAPEST NO SUB PARTS)/SUSTNBLTY SOL ")
169      1100 FORMAT (//,10X, "COST LIMIT OF", F12.0, " APPROXIMATED BY", F12.0, //,
170      *10X, "USING A SUSTAINIBILITY SOLUTION FOR COST THRU", I4, " DAYS ")
171      1300 FORMAT (10X, "PART NR", 17X, "PART", 21X, "RQMT", 7X, "COST", "COST")
172      1400 FORMAT (2X,I5,I10,5X,A16,2X,A16,F8.1,F12.0,F6.2,4X)
173      END
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CAA-D-85-3

(NOT USED)

SUBROUTINE DIST

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1          SUBROUTINE DIST (IFDAY, ILDAY, DANT, K)
2          NAME: DIST          TYPE: SUBROUTINE
3          PURPOSE: THE DIST (PARTS DISTRIBUTION) SUBROUTINE DISTRIBUTES THE
4          STARTING SPARES STOCK OF A PART TYPE OVER A SERIES OF 5-DAY INTERVALS
5          CALLED BY: MAIN PROGRAM
6          CALLS : NONE
7          FILES USED : NO FILES READ OR WRITTEN
8
9          ARGUMENTS
10
11          NAME          TYPE          DESCRIPTION
12
13          IFDAY         FIXED         FIRST DAY OF PERIOD OVER WHICH THE STOCK IS
14          ILDAY          FIXED         LAST DAY OF PERIOD OVER WHICH THE STOCK IS DISTRIBUTED
15          DANT          REAL          AVERAGE AMOUNT OF STOCK DISTRIBUTED EACH DAY DURING
16          K              FIXED         PART NUMBER OF THE PART BEING DISTRIBUTED
17
18          LOCAL ARRAYS : NONE
19
20
21
22
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37
38
39          COMMON BLOCK (UNLabeled) ENTRIES
40
41
42          NAME          DIMENSION      TYPE          DESCRIPTION
43
44          PTDEP(I,J,K)  300,24  REAL         TOTAL AMOUNT OF INITIAL STOCK FOR PART J
45          RECEIVED AT THEATER (EXCLUDING IN-PLACE STOCK)
46          BETWEEN DAY 5+K-4 AND DAY 5+K
47
48
49          COMMON
50          *      AC(120),      ACL,      ADESC(300),      ALLOW1(120),
51          *      ALLOW2(120),     AMSN(300),     ASURV(120),     AVAV6(6),
52          *      AVH(120),      BCV(300),      BF13001,      CASE,
53          *      CDMDA(300),     CF(300),      CL,          CHINT,
54          *      CNCS(300),      COST(300),     CRNCS(300),     DCOST(300),
55          *      DCOSTF(120),     DCY(300),      DF(300),      DMD(300),
56          *      DDO(300),      FMA(120),      FHM,          FHPAPD13(120),
57          *      FHR(120),      ICOST,      IDC(12),      IFMC(120),
58          *      IFS(300),      IMSEL,      INS(300),      INT,
59          *      IPT(100),      ITC(300),     IRO(300),      ISHORT,
60          *      NP,          NP1,      NP2,          NW,
61          *      PTDEP(300,24),  OPA(300),     RNC(120),      RNCS(300),
62          *      SM(120,100),    SRMAX1(300),   STK(300),      SUMB(120),
63          *      TRNCS(300),    TSTK(300),    TSUMB,
64          *      CHARACTER*16,
65          *      ADESC,          ADESC,     AMSN,          CASE
66
67          *      CALCULATE :
68          *      DI=5-(NR OF DAYS OF DISTRIBUTION IN FIRST 5-DAY INTERVAL OF DISTRIBUTION PERIOD)
69          *      DL=NR OF DAYS OF DISTRIBUTION IN LAST 5-DAY INTERVAL OF DISTRIBUTION PERIOD
70          *      TI=ORDINAL NR (IN FULLWAL) OF FIRST 5-DAY INTERVAL IN DISTRIBUTION PERIOD
71          *      IL=ORDINAL NR (IN FULLWAL) OF LAST 5-DAY INTERVAL IN DISTRIBUTION PERIOD
72
73          *      DI=-(IFDAY-1)/5+5+IFDAY-1
74          *      DL=-(ILDAY-1)/5+5+ILDAY
75          *      TI=MIND(24, (IFDAY-1)/5+1)
76          *      IL=MIND(24, (ILDAY-1)/5+1)
77          *      IF (TI < IL) GO TO 100
78          *      PTDFP(K,II)=PTDEP(K,II)+(DL-DI)*DANT
79          *      RETURN
80          100 DO 200 I=TI,IL
81          *      IF (I.EQ.21) PTDEP(K,I)=PTDEP(K,I)+(5.-DI)*DANT

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82
83 IF (I.EQ.IL) PTDEP(K,I)=PTDEP(K,I)+DL+DAHT
84 IF (I.GT.I1.AND.I.LT.IL) PTDEP(K,I)=PTDEP(K,I)+S.+DAHT
85 200 CONTINUE
86 RETURN
 END

SUBROUTINE MAXC

```

1 SUBROUTINE MAXC (NDUMMY,NOUT)
2 NAME: MAXC          TYPE: SUBROUTINE
3 PURPOSE: THE MAXC SUBROUTINE FINDS THE SUBSCRIPT OF THE LARGEST IN VALUE
4 MEMBER OF AN ARRAY (D00(J))
5
6 CALLED BY:
7   - MAIN PROGRAM
8   - SUBROUTINE UCROPS
9   - SUBROUTINE CLIST
10
11 CALLS : NONE
12 FILES USED : NO FILES READ OR WRITTEN
13
14 ARGUMENTS
15
16 NAME          TYPE          DESCRIPTION
17
18 NDUMMY        FIXED        THE NR OF ITEMS IN THE ARRAY BEING PROCESSED
19 NOUT          FIXED        THE SUBSCRIPT ASSOCIATED WITH THE LARGEST VALUE
20
21
22 LOCAL ARRAYS : NONE
23
24
25 COMMON BLOCK (UNLABLED) ENTRIES
26
27 NAME          DIMENSION    TYPE          DESCRIPTION
28
29 D00(J)        300          REAL         ARRAY STORING THE ATTRIBUTE TO BE SORTED ON
30
31 IN SUBROUTINE MAXC. IN MAIN PGM, THIS HAS PART
32 UNIT COST FOR PART J. IN SUBROUTINES CLIST &
33 UCROPS, THIS HAS THE AMOUNT OF THE SOLUTION
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COMMON
  *    AC(120),      ACL,      ADESC(300),      ADESC(300),
  *    ALLOW1(120),   AMSN(300),  ASURV(120),   AVAV8(6),
  *    AVN(120),     BCY(300),   BF(300),      CASE,
  *    COMDA(300),   CF(300),   CL,          CMINT,
  *    CNCS(300),   COST(300),  CRNCS(300),   OCOST(300),
  *    DCOSTP(120),  DCY(300),   DF(300),      DM(300),
  *    D00(300),     FMA(120),   FMM,          FNPAPD(3,120),
  *    FMA(120),     FCOST,     IDC(2),      IFHC(120),
  *    FMS(300),     INSEL,     INS(300),     INT,
  *    IPT(100),     INC(300),   IPG(300),     ISMORT,
  *    NP,          NP1,      NP2,          NW,
  *    PTDEP(300,24), OPA(300),  RNC(120),   RNCS(300),
  *    SM(120,100),  SRMAX1(300), STK(300),   SUMB(120),
  *    TRNC(300),    TSTK(300),  TSUMB,
  CHARACTER(16)
  *    ADESC,        AMSN,      CASE
  *    SMAX=-1.
  *    JMAX=1
  DO 100 J=1,NDUMMY
  *    X=D00(J)
  *    ZMAX=MAX1(SMAX,X)
  IF (ZMAX.LE.SMAX) GO TO 100
  JMAX=J
  SMAX=ZMAX
100 CONTINUE
NOUT=JMAX
RETURN
END

```

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(NOT USED)

SUBROUTINE NCRNCT

```

1      SUBROUTINE NCRNCT (IND,I2,IND)
2      NAME: NCRNCT      TYPE: SUBROUTINE
3
4      PURPOSE: THE NCRNCT (NO CANNIBALIZATION REQUIREMENTS) SUBROUTINE
5      GENERATES A LEAST COST REQNTS MIX OF SPARE PARTS NEEDED TO ACHIEVE A
6      FLEET FLYING HR PROGRAM/AVAILABILITY OBJECTIVE USING A USER-SPECIFIED
7      PARTS REPLACEMENT POLICY AND UNCONSTRAINED COSTS.
8
9      CALLED BY: SUBROUTINE UCROPS
10
11      CALLS
12          -FUNCTION SR: COMPUTES CUMULATIVE NET DEMAND THRU A SPECIFIED DAY
13          FOR A SPECIFIED PART
14
15      FILES USED : NO FILES READ OR WRITTEN
16
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ARGUMENTS

NAME	TYPE	DESCRIPTION
ND	FIXED	CURRENT DAY BEING PROCESSED
I2	FIXED	NR OF ALLOWABLE NMCS ACFT ASSOCIATED WITH THE NO-SUB PART SET AT THIS STAGE OF THE REQNT ALGORITHM
IND	FIXED	INDICATOR OF WHETHER TOTAL (INIT STK=0) OR RESIDUAL (INIT STK='CURRENT INVENTORY') REQNTS ARE BEING PROCESSED. IND=1 INDICATES TOTAL REQNTS. IND=2 INDICATES RESIDUAL REQNTS.

LOCAL ARRAYS

NAME	DIMENSION	TYPE	DESCRIPTION
SUMBZ(I)	120	REAL	CUMULATIVE RAW (INIT STK=0) DEMANDS (ALL PARTS) THRU DAY I
SUMP(I)	120	REAL	TOTAL UNITS (ALL PARTS) STOCKED IN EXCESS OF EXPECTED DEMAND ON DAY I

COMMON BLOCK (UNLABELED) ENTRIES

NAME	DIMENSION	TYPE	DESCRIPTION
ALLOW1(I)	120	REAL	THE 'ALLOWABLE NMCS ACFT' FOR THE NO-SUB SET ON DAY I, COMPUTED AFTER DAY I IS PROCESSED. AFTER IT IS CALCULATED FOR DAY I, IT IS FIXED DURING ITERATIVE CALCULATIONS (INVOLVING DAY I) FOR NO-SUB REQNTS ON LATER DAYS.
ALLOWB(I)	120	REAL	MAXIMUM ALLOWABLE NMCS AC ON DAY I WHICH WILL STILL ALLOW ACHIEVEMENT OF CASE OBJECTIVE (FLYING HOUR AND AVAILABILITY) ON DAY I
COND(I,J)	300	REAL	ARRAY USED TO STORE THE CUMULATIVE NET DEMAND (BASED ON INITIAL STK=0) FOR PART J ON THE SCENARIO DAY BEING PROCESSED
CRNCS(I,J)	300	REAL	THE UNCONSTRAINED COST SOLUTION REQNT FOR PART J AT ANY STAGE OF THE PARTIAL SUB REQUIREMENT CALCULATION ALGORITHM.
INS(I,J)	300	FIXED	ARRAY STORING THE PART NUMBER OF THE PARTS IN THE NO-SUB PART SET.
INT	1	FIXED	THE INTERVAL AT WHICH THE PARTIAL SUB COMPUTATION ALGORITHM (ROUTINE UCROPS) INCREMENTS VALUES FOR 'ALLOWABLE NMCS ACFT'

```

82      C      AT EACH STAGE OF CALCULATION OF SEPARATE REQMT
83      C      SOLUTIONS FOR THE FULL-SUB SET AND THE NO-SUB
84      C      SET. ALWAYS SET=1 FOR RELIABLE RESULTS. ITS
85      C      VALUE IS SET =1 IN THE PROGRAM CODE.
86
87      C      NP2      1 FIXED   TOTAL NUMBER OF "PART NUMBERS" IN THE NO-SUB
88      C      PART SET
89      C      RNCS(J)    300 REAL    TOTAL REQMT(INIT STK=0) FOR PART J USING A
90      C      "NO SUBSTITUTION" REPLACEMENT POLICY
91      C      WITH UNCONSTRAINED COST
92
93      C      TSUMB     1 REAL    THE TOTAL NET STOCKOUT FROM ALL NO-SUB PARTS
94      C      PROCESSED AT ANY STAGE OF THE NO-SUB REQMTS
95      C      CALCULATION PORTION OF THE PARTIAL SUB REQMT
96      C      ALGORITHM
97
98      C
100      C      COMMON
101      C      * AC(120),      ACL,      ADESC(300),      ALLOW1(120),
102      C      * ALLOWB(120),  AMSN(300),  ASURV(120),  AVG(6),
103      C      * AVH(120),    BCY(300),  BF(300),    CASE,
104      C      * CDMOA(300),  CF(300),  CL,        CMINT,
105      C      * CNCS(300),   COST(300), CRNCS(300), DCOST1(300),
106      C      * DCOSTF(120), DCY(300), DF(300),  DMD(300),
107      C      * DOD(300),   FHA(120),  FHM,      FHPAPO(3,120),
108      C      * FHR(120),   ICOST,    IDCC(2),    IFHC(120),
109      C      * IFS(300),   IMSEL,    INS(300),  INT,
110      C      * IPT(100),   IRC(300), IRO(300),  ISHORT,
111      C      * NP,       NP1,      NP2,      NW,
112      C      * PTDFP(300,24), QPA(300), RNC(120), RNCS(300),
113      C      * SM(120,100), SRMAX1(300), STK(300), SUMB(120),
114      C      * TRNCS(300), TSTK(300), TSUMB
115      C      DIMENSION
116      C      * SUMBZ(120),  SUMP(120)
117      C      CHARACTER*16
118      C      * ADESC,      ADSC,      AMSN,      CASE
119      C      NA=ALLOWB(ND)*.5
120      C      IF (I2.LT.NA) GO TO 200
121      C      SUMBZ=0.
122      C      TSUMB=0.
123      C      DO 100 L=1,ND
124      C      SUMP(L)=0.
125      C      100 SUMBZ(L)=0.
126      C      200 TOTZ=0.
127
128      C      ALL PARTS ARE PROCESSED FOR THIS DAY(ND) IN THE FOLLOWING LOOP
129
130      C      DO 700 K=1,NP2
131      C      I=INS(K)
132
133      C      MAKE A DIRECT CALCULATION OF NET DEMAND(BASED ON INIT STK=0) ONLY
134      C      FOR THE COMBINATION (I1,I2) IN WHICH ALLOWED NMCS ACFT FOR THE NO-SUB
135      C      PARTS(I2)=ALLOWED NMCS ACFT FOR ALL PARTS(ALLOWB(ND)) OTHERWISE DO
136      C      A SHORT-CUT CALCULATION
137
138      C      IF (I2.LT.NA) GO TO 400
139      C      CDMOA(I2)=0.
140
141      C      ASSUME THAT THE (PREVIOUSLY COMPUTED) MIN REQMT(RNCS) PLUS ISSUED
142      C      STOCK AS OF THIS DAY(TSTK) ARE "BOUGHT", I.E. THESE ARE "SUNK" COSTS.
143
144      C      CRNCS(I1)=RNCS(I1)
145      C      IF (IND.EQ.2) CRNCS(I1)=TSTK(I1)+RNCS(I1)
146
147      C      FOR EACH PART, RECURSIVELY COMPUTE THE EFFECTS OF REQMT "BUYS" THRU
148      C      ALL DAYS UP TO CURRENT DAY I IN THE FOLLOWING LOOP.
149
150
151      C      CALC CUMULATIVE NET DEMAND (CDMD) FOR PART I1 THRU DAY I.
152      C      THEN CALC (SUMBZ(I)) TOTAL NET DEMAND THRU DAY I OVER THE K MOST
153      C      EXPENSIVE PART TYPES. FINALLY CALC (TSUMB) THE NET TOTAL STOCKOUT
154      C      ("HOLES") THRU DAY I AND SET THE ROMNT FOR PART I1= THE DIFFERENCE
155      C      BETWEEN THE NET TOTAL STOCKOUT AND THE ALLOWABLE STOCKOUT(ALLOWB(I)).
156      C      THIS CALC IMPLICITLY ASSUMES (THRU SUMR) THAT THE ROMNTS FOR THE
157      C      (K-1) MOST EXPENSIVE PARTS HAVE BEEN COMPUTED AND BOUGHT.
158
159      C      DO 300 I=1,ND
160      C      CDMOA=CDMOA(I1)
161      C      CDMOA(I1)=SR(I1,I1,CDMD)
162      C      IF (IND.EQ.2) SUMP(I)=SUMP(I)+AMAX1(0.,(CRNCS(I1)-CDMOA(I1)))
163      C      SUMBZ(I)=SUMBZ(I)+CDMOA(I1)

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164      TSUMB=AMAX1(SUMBZ(I))-SUMR+SUMP(I),0.)
165      IF ((TSUMB-CRNCs(I)) .GE. ALLOW(I)) CRNCs(I)=TSUMB-ALLOW(I)
166      300  CONTINUE
167
168      C CALC (SUMR) TOTAL UNITS STOCK REQUIRED FOR THE K MOST EXPENSIVE
169      C PARTS
170
171      SUMR=SUMR+CRNCs(I)
172      GO TO 700
173
174      C THE FOLLOWING IS THE SHORT-CUT CALCULATION OF REQMTS FOR THE NO-SUB
175      C CASE. GIVEN THE THE BASE REQMT, I.E. THE DIRECTLY COMPUTED NO-SUB
176      C REQMT FOR THE CASE WITH ALLOWED NMCS ACFT FOR THE NO-SUB SET(I2)=NA,
177      C THEN, IF N FEWER NMCS ACFT ARE ALLOWED (FOR THE NO-SUB SET), THE
178      C COST-EFFECTIVE APPROACH IS TO BUY N MORE OF THE CHEAPEST PARTS WHOSE
179      C REQMTS IN THE BASE(I2=NA) SOLUTION(+INIT STK) ARE <LT. THEIR NET DEMAND.
180      C FRACTIONAL REQMTS IN THE BASE SOLUTION COMPLICATED THE PROGRAMMING.
181
182      400  ZINT=MIN0(INT,NA-I2)
183      IF (I2.GE.(TSUMB+.5)) RETURN
184      IL=INS(NP2-K+1)
185      IF ((CRNCs(IL)+(IND-1)*ZINT*TSTK(IL)) .GE. CDMDA(IL)) GO TO 700
186      Z=CRNCs(IL)+ZINT
187      TZ=Z+(IND-1)*ZINT*TSTK(IL)-CDMDA(IL)
188      IF (TZ.LE.0) GO TO 500
189      CRNCs(IL)=CDMDA(IL)-(IND-1)*ZINT*TSTK(IL)
190      TOTZ=TOTZ+ZINT-TZ
191      IF (TOTZ.LT.ZINT) GO TO 700
192      CRNCs(IL)=CRNCs(IL)-TOTZ+ZINT
193      GO TO 600
194      500  CRNCs(IL)=CRNCs(IL)+AMIN1(ZINT-TOTZ,ZINT)
195      600  TSUMB=TSUMB-ZINT
196      RETURN
197      700  CONTINUE
198      IF (I2.EQ.NA) TSUMB=TSUMB-CRNCs(I)
199      IF (I2.LT.NA.OR.IND.EQ.1) RETURN
200
201      C FOLLOWING CONVERTS REQMT TO AN ADD-ON (RESIDUAL) REQMT BY SUBTRACTING
202      C OUT INITIAL STOCK (TSTK) ISSUED THRU THIS DAY(ND)
203
204      DO 800 K=1,NP2
205      J=INS(K)
206      800  CRNCs(J)=CRNCs(J)-TSTK(J)
207      RETURN
208      END

```

CAA-D-85-3

(NOT USED)

SUBROUTINE UCCAP

```

1      SUBROUTINE UCCAP (IND)
2      NAME: UCCAP          TYPE: SUBROUTINE
3
4      PURPOSE: THE UCCAP (UNCONSTRAINED COST CAPABILITY ASSESSMENT) SUBROUTINE
5      COMPUTES FLEET CAPABILITY (AVG AVAILABILITY, PGM FLYING HRS/ACFT/DAY) BASED
6      ON THE UNCONSTRAINED COST SOLUTION REQMT BEING STOCKED IN THE WAR RESERVE
7
8      CALLED BY: MAIN PROGRAM
9
10     CALLS
11     -FUNCTION SR: COMPUTES CUMULATIVE NET DEMAND THRU A SPECIFIED DAY
12           FOR A SPECIFIED PART
13
14     FILES USED : INPUT - NONE
15           OUTPUT - UNIT 6(PRINT)
16
17
18     ARGUMENTS
19
20
21     NAME          TYPE          DESCRIPTION
22
23
24     IND           FIXED         INDICATOR OF WHETHER TOTAL (INIT STK=0) OR
25           RESIDUAL (INIT STK='CURRENT INVENTORY') REQMTS
26           ARE BEING PROCESSED. IND=1 INDICATES TOTAL
27           REQMTS. IND=2 INDICATES RESIDUAL REQMTS.
28
29
30     LOCAL ARRAYS : NONE
31
32
33     COMMON BLOCK (UNLABLED) ENTRIES
34
35
36     NAME          DIMENSION    TYPE          DESCRIPTION
37
38
39     ALLOWB(I)     120          REAL          MAXIMUM ALLOWABLE NMCS AC ON DAY I WHICH
40           WILL STILL ALLOW ACHIEVEMENT OF CASE OBJECTIVE
41           (FLYING HOUR AND AVAILABILITY) ON DAY I
42
43     ASURV(I)      120          REAL          NR AC SURVIVING (NOT ATTRITTED) ON DAY I
44
45     AVAVG(1)      6             REAL          AVAVG(1)=AVG ACFT AVAIL. FROM CAPABILITY
46           ASSESSMENT, BASED ON STOCKAGE OF EITHER
47           Curr Inv OR ( Curr Inv + COMPUTED ADD-ON
48           REQMTS SOLUTION)
49
50           AVAVG(2)=AVG MIN ACFT REQ'D TO ACHIEVE
51           THE FLYING HR/AVAILABILITY OBJECTIVE.
52
53           AVAVG(3)=AVG FLY HR/AVAIL ACFT / DAY
54           FROM CAPABILITY ASSESSMENT, BASED ON
55           EITHER Curr Inv OR ( Curr Inv + THE SOLUTION
56           REQMT) BEING STOCKED.
57
58     AVM(I)        120          REAL          AC AVAILABILITY CONSTRAINT (MIN REQUIRED
59           NON-NMCS ACFT) FOR DAY I.
60
61     CASE          CHAR         CASE ID
62
63     COMDA(J)      300          REAL          ARRAY USED TO STORE THE CUMULATIVE NET DEMAND
64           (BASED ON INITIAL STK=0) FOR PART J ON THE
65           SCENARIO DAY BEING PROCESSED
66
67     DMD(IJ)       300          REAL          WORKING VARIABLE USED IN CALCULATION OF
68           NET DEMAND(SR(I,J,...)) FOR PART J ON DAY I
69           DURING CAPABILITY ASSESSMENT.
70           WHEN (CUM)NET DMD THRU DAY I IS BEING
71           CALCULATED, DMD(IJ) IS (CUM) NET DMD THRU THE
72           PREVIOUS DAY.
73
74     D00(J)        300          REAL          ARRAY STORING THE ATTRIBUTE TO BE SORTED ON
75           IN SUBROUTINE MAXC. IN MAIN PGM, THIS HAS PART
76           UNIT COST FOR PART J. IN SUBROUTINES CCLIST &
77           UCRQPS, THIS HAS THE AMOUNT OF THE SOLUTION
78           REQMT FOR PART J.
79
80     FHM           REAL         MAXIMUM FLYING HRS PER ACFT PER DAY (INPUT)
81

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AD-A152 530 EXTENDED PARTS REQUIREMENTS AND COST MODEL (PARCOM)
FUNCTIONAL DESCRIPTIO. (U) ARMY CONCEPTS ANALYSIS
AGENCY BETHESDA MD W J BAUMAN MAR 85 CAA-D-85-3

2/2

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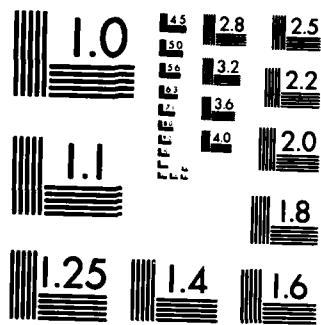
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NL

END

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DTIC



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

FHPAPOE(K,I) 3,120 REAL FHPAPO(I,I)=FLYING HRS PER AVAILABLE ACFT PER DAY I UNDER THE SPECIFIED REPLACEMENT POLICY BASED ON STOCKING (CURRENT INV + THE UNCONSTRAINED COST SOLUTION)

FHR(I) 120 REAL FLEET PROGRAM FLYING HRS REQUIRED ON DAY I ACCORDING TO THE INPUT FLYING HR PROGRAM

IFNC(I) 120 FIXED INDICATOR TELLING WHICH CONSTRAINT FLY HR PGM (IFNC(I)=0) OR ACFT AVAILABILITY (IFNC(I)=1) DETERMINES REQUIRED DAILY FLEET AVAILABILITY FOR DAY I

IFS(I,J) 300 FIXED ARRAY STORING THE PARCOM PART NUMBERS OF THE PARTS IN THE FULL-SUB PART SET.

INS(I,J) 300 FIXED ARRAY STORING THE PARCOM PART NUMBERS OF THE PARTS IN THE NO-SUB PART SET.

NP 1 FIXED NR OF PART TYPES PROCESSED IN RUN. (THIS EXCLUDES PART TYPES WITH ESSENTIALITY CODE =LE, IESS OR WITH A ZERO FAILURE RATE)

NP1 1 FIXED TOTAL NUMBER OF "PART NUMBERS" IN THE FULL-SUB PART SET

NP2 1 FIXED TOTAL NUMBER OF "PART NUMBERS" IN THE NO-SUB PART SET

NM 1 FIXED LENGTH(DAYS) OF SCENARIO

PTOEP(J,K) 300,24 REAL TOTAL AMOUNT OF INITIAL STOCK FOR PART J RECEIVED AT THEATER EXCLUDING IN-PLACE STOCK BETWEEN DAY SOK-4 AND DAY SOK

QPA(I,J) 300 REAL THE "QUANTITY PER APPLICATION" FOR PART J. I.E. THE STANDARD NUMBER OF ITEMS OF PART J INSTALLED ON EACH OPERATIONAL ACFT

RNC(I) 120 REAL AC AVAILABILITY WHEN TOTAL REQ(INIT STR=0) IS STOCKED USING A "NO SUBSTITUTION" REPLACEMENT POLICY WITH UNCONSTRAINED COST

RNC5(I,J) 300 REAL TOTAL REQUANTITY STR=0 FOR PART J USING A "NO SUBSTITUTION" REPLACEMENT POLICY WITH UNCONSTRAINED COST

STK(I,J) 300 REAL INITIAL SERVICEABLE STOCK OF PART J. IT IS THE SERVICEABLE WAR RESERVE + (IN-PLACE ASL/PLL ON DAY I)

SUNB(I) 120 REAL TOTAL STOCKOUTS OVER ALL PARTS IN THE NO-SUB PART SET AS CALCULATED DAY I DURING CAPABILITY ASSESSMENT

TSTK(I,J) 300 REAL THE CUMULATIVE STOCK DEPLOYED FOR PART J ON THE DAY BEING PROCESSED

COMMON

AC(120)	AC(3)	ADESC(300)	ALLOW1(120)
ALLINV(120)	ASN(300)	ASURV(120)	AVAVB(6)
AVM(120)	BCT(300)	BF(300)	CASE
COMDA(300)	CF(300)	CL	CRINT
CMCS(1300)	COST(300)	CRNCS(300)	DCOST(300)
DCOSTP(120)	DCY(300)	DF(300)	DMO(300)
DO(300)	FN(120)	FHM	FHPAPO(3,120)
FHR(120)	ICOST	IDCC(12)	IFNC(120)
IFS(300)	INSEL	INS(300)	INT
IFT(100)	IRGC(300)	IRO(300)	ISMORT
NP	NP1	NP2	ND
PTOEP(300,24)	OP1	RNC(120)	RNC5(300)
SH(120,120)	SRMAX(1300)	STR(120)	SUMB(120)
CHARACTER=16	TSTR(300)	TSUMB	
ADESC	ADSC	AMSN	CASE
RAY			

```

164      TAV=0.
165      TAV1=0.
166      DO 100 I=1, NP
167          TSTK(I)=STK(I)
168          DOD(I)=0.
169      100 DMD(I)=0.
170      DO 300 L=1, NW
171          DO 200 I=1, 3
172              FHPAPD(I,L)=0.
173      200 SUMB(L)=0.
174      300 SUMB(L)=0.
175      DO 400 I=1, 3
176          400 AVG(I)=0.
177
178      C THRU STMT 1000 PROCESS EACH DAY I
179      C
180          DO 1000 I=1, NW
181              IA=(I-1)/5+1
182
183      C SET TSTK(I)= ISSUED INITIAL STK THRU DAY I
184      C
185          DO 500 J=1, NP
186              500 TSTK(J)=TSTK(J)+PTDEP(J,IA)/5.
187              BMAX=0.
188              IF (NP2.EQ.0) GO TO 700
189
190      C THRU STMT 500 DO NMCS ACFT ASSESSMENT FOR THE NO-SUB SET.
191      C ZPENET DEMAND (BACKORDERS) FROM PART K SUMB(I)= TOTAL NO-SUB BACKORDERS
192      C =TOTAL NMCS ACFT FROM ALL NO-SUB PARTS ON DAY I.
193      C
194          DO 600 K=1, NP2
195              II=INS(K)
196              X=DMD(II)
197              DMD(II)=SR(I,II,X)
198              ZP=RNCS(II)
199              IF (IND.EQ.2) ZP=RNCS(II)+TSTK(II)
200              600 SUMB(I)=SUMB(I)+AMAX(0.,DMD(II)-ZP)
201              700 IF (NP1.EQ.0) GO TO 900
202
203      C THRU STMT 700 DO NMCS ACFT ASSESSMENT FOR THE FULL-SUB SET.
204      C BOFCS=NET DEMAND (BACKORDERS) FROM PART K/OPA = NMCS ACFT FROM THIS
205      C FULL-SUB PART. BMAX = TOTAL NMCS ACFT FROM ALL FULL-SUB PARTS PROCESSED
206      C
207          DO 800 K=1, NP1
208              II=IFS(K)
209              X=DMD(II)
210              DMD(II)=SR(I,II,X)
211              ZP=RNCS(II)
212              IF (IND.EQ.2) ZP=RNCS(II)+TSTK(II)
213              BOFCS=(DMD(II)-ZP)/OPA(II)
214              IF (BOFCS.LE.0.) BOFCS=0.
215              BMAX=AMAX(BMAX,BOFCS)
216
217      C 800 CONTINUE
218
219      C CALC ACFT AVAILABLE (RNCS(II)) FOR DAY I AS SURVIVING ACFT-TOTAL COMBINED
220      C (ALL PARTS) NMCS ACFT. CALC PGM FLYING HRS/ACFT/DAY=FHPAPD(I,I) AND
221      C ACCUMULATE (TAVI) THE ACFT AVAILABLE.
222      C
223          900 RNC(I)=AMAX(0.,ASURV(I)-BMAX-SUMB(I))/IASURV(I)+.0001
224          FHPAPD(I,I)=AMIN1(FHM,FMR(I))/IASURV(I)-BMAX-SUMB(I)+.0201
225          TAVI=TAVI+RNC(I)*ASURV(I)
226
227      C 1000 CONTINUE
228      C TSURV=0.
229
230      C PRINT THE TABLE OF DAILY UNCONSTRAINED COST CAPABILITY ASSESSMENT W/AVGS
231
232          DO 1200 I=1, NW
233              AX=1.-(ALLOW8(I)/(ASURV(I)+.000001))
234              IF (MOD(I-1,50).NE.0) GO TO 1100
235              WRITE (6,1400) CASE
236              WRITE (6,1500)
237              IF (IND.EQ.1) WRITE (6,1600)
238              IF (IND.EQ.2) WRITE (6,1700)
239              WRITE (6,1800)
240              WRITE (6,1800)
241              WRITE (6,1950)
242              WRITE (6,2000)
243              WRITE (6,2100)
244              WRITE (6,1800)
245
246          1100 TSURV=TSURV+ASURV(I)
247
248      C CALC AVG ACFT AVAILABLE (AVAVG(1)) WEIGHTED BY DAILY NR OF ACFT SURVIVING.
249      C CALC AVG PGM FLYING HRS/ACFT/DAY (AVAVG(3)), WEIGHTED BY DAILY NR OF ACFT

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246      C AVAILABLE.
247      AVAVG(1)=AVAVG(1)+RNC(I)*ASURV(I)
248      AVAVG(2)=AVAVG(2)+AX*ASURV(I)
249      AVAVG(3)=AVAVG(3)+FHPAPD(1,I)*RNC(I)*ASURV(I)/(TAVI*.0001)
250      RAV=" FLYING MP PROG"
251      IF (IFHC(I),EQ.1) RAV=" AVAIL CONSTRAIN"
252      1200 WRITE (6,2200) I,RNC(I),AX,RAV,AVM(I),FHPAPD(1,I),I
253      DO 1300 K=1,2
254      1300 AVAVG(K)=AVAVG(K)/TSURV
255      WRITE (6,2300) (AVAVG(K),K=1,3)
256      RETURN
257      1400 FORMAT (1H1,30X,"CASE= ",A16)
258      1500 FORMAT (/,1X,"* FORCE CAPABILITY GIVEN THAT THE COMPUTED*,* REQU
259      *IREMENT (FOR EACH POLICY) IS STOCKED **")
260      1600 FORMAT (/,1X,"** ASSUMES TOTAL(INIT STK=0) REQMTS*,* STOCKED AT
261      *RETAIL (NO POST D-DAY PARTS DEPLOYED) **")
262      1700 FORMAT (/,15X,"** CASES ASSUME RESIDUAL(INIT STK=CURR STK)*,* RE
263      *QMTS ARE STOCKED AND DEPLOYED **")
264      1800 FORMAT (/)
265      1950 FORMAT (/,16X,"AIRCRAFT AVAILABILITY",27X,"ACHIEVED")
266      2000 FORMAT (21X,"ACHIEVED",33X,"FLY HRS/AC")
267      2100 FORMAT (19X,"DAY",6X,"AVAIL",10X,"REQ AVAIL",10X,"AVAIL",10X,"SOURC
268      *E",6X,"/DAY",5X,"/DAY")
269      2200 FORMAT (19X,1X,F10.3,6X,F5.3,F5.2,F10.1,18)
270      2300 FORMAT (/,1X," AVERAGE=",10X,F5.3,6X,F5.3,21X,F10.1)
271      END
272

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SUBROUTINE UCRQPS

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1 SUBROUTINE UCRQPS (IND,IOPT4,IOPTS,IORD)
2 C NAME: UCRQPS      TYPE: SUBROUTINE
3 C PURPOSE: THE UCRQPS (UNCONSTRAINED COST RQMTS-PARTIAL SUBSTITUTION)
4 C SUBROUTINE COMPUTES AND PRINTS THE LEAST COST RQMTS MIX OF SPARE PARTS
5 C PARTS NEEDED, GIVEN UNCONSTRAINED FUNDS, TO ACHIEVE THE CASE OBJECTIVE
6 C
7 C CALLED BY: MAIN PROGRAM
8 C
9 C CALLS:
10 C   -FUNCTION SR: COMPUTES CUMULATIVE NET DEMAND THRU A SPECIFIED DAY
11 C   FOR A SPECIFIED PART
12 C   -SUBROUTINE MAXC: ORDERS LIST OF PART RQMTS TO BE PRINTED
13 C   -SUBROUTINE NCNC: COMPUTES THE RQMTS SOLUTION FOR THE "NO SUB" PART
14 C   SET AND A SPECIFIC ALLOWED STOCKOUT FOR THAT SET
15 C
16 C FILES USED : INPUT - NONE
17 C                 OUTPUT - UNIT 6 (PRINT)
18 C
19 C ARGUMENTS
20 C
21 C   NAME      TYPE      DESCRIPTION
22 C
23 C   IND       FIXED     INDICATOR OF WHETHER TOTAL (INIT STK=0) OR
24 C   C             RESIDUAL (INIT STK="CURRENT INVENTORY") RQMTS
25 C   C             ARE BEING PROCESSED. IND=1 INDICATES TOTAL
26 C   C             RQMTS. IND=2 INDICATES RESIDUAL RQMTS.
27 C
28 C   IOPT4     FIXED     RUN OPTION(INPUT). IF IOPT4 .LE. 0, THEN THE
29 C   C             UNCONSTRAINED COST SOLUTION RQMTS LIST WILL NOT
30 C   C             BE PRINTED (BUT WILL BE COMPUTED INTERNALLY).
31 C   C             IF IOPT4 .GT. 0 THE LIST WILL BE PRINTED.
32 C
33 C   IOPTS     FIXED     RUN OPTION(INPUT). IF IOPTS .LE. 0, THEN THE
34 C   C             "CUMULATIVE (UNCONSTRAINED COST)" RQMTS COSTS THRU
35 C   C             DAY N. LIST WILL NOT BE PRINTED. IF IOPTS .GT. 0
36 C   C             THE LIST WILL BE PRINTED.
37 C
38 C   IORD     FIXED     RUN OPTION(INPUT). IF IORD .LE. 0, THEN THE
39 C   C             SOLUTION RQMTS LISTS WILL BE ORDERED ACCORDING
40 C   C             TO DECREASING UNIT COST OF PART. IF IORD .GT. 0
41 C   C             THE RQMTS LISTS ARE ORDERED BY (DECREASING)
42 C   C             AMOUNT OF SOLUTION RQMT.
43 C
44 C LOCAL ARRAYS
45 C
46 C   NAME      DIMENSION  TYPE      DESCRIPTION
47 C   RNINIJ:    300  REAL    STORES EITHER 0 OR CRNCS(J) FOR PART J
48 C
49 C COMMON BLOCK (UNLABLED) ENTRIES
50 C
51 C   NAME      DIMENSION  TYPE      DESCRIPTION
52 C
53 C   ACL       1  REAL    THE AMOUNT(S) OF SUSTAINABILITY DOLLARS;
54 C   C             BASED ON THE "CUM RQMT COST THRU DAY N"
55 C   C             TABLES, WHICH IS THE CLOSEST APPROXIMATION
56 C   C             TO THE INPUT COST LIMIT FOR THE CONSTRAINED
57 C   C             COST CASE
58 C
59 C   ADESCIJ:   300  CCHAR   16 CHAR DESCRIPTION OF SPARE PART J
60 C
61 C   ALLOWIJ:   120  REAL    THE "ALLOWABLE NMCS ACFT" FOR THE NO-SUB
62 C   C             SET ON DAY I, COMPUTED AFTER DAY I IS PROCESSED.
63 C   C             AFTER IT IS CALCULATED FOR DAY I, IT IS FIXED
64 C   C             DURING ITERATIVE CALCULATIONS (INVOLVING DAY I)
65 C
66 C
67 C
68 C
69 C
70 C
71 C
72 C
73 C
74 C
75 C
76 C
77 C
78 C
79 C
80 C
81 C

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82	C			FOR NO-SUB REQMTS ON LATER DAYS.
83	ALLOW(I)	120	REAL	MAXIMUM ALLOWABLE NMCS AC ON DAY I WHICH
84				WILL STILL ALLOW ACHIEVEMENT OF CASE OBJECTIVE
85				(FLYING HOUR AND AVAILABILITY) ON DAY I
86				
87	AMSN(J)	300	CHAR	IDENTIFICATION NR(MSN) OF SPARE PART J
88	CASE		CHAR	CASE ID
89	COND(I,J)	300	REAL	ARRAY USED TO STORE THE CUMULATIVE NET DEMAND
90				(BASED ON INITIAL STKED) FOR PART J ON THE
91				SCENARIO DAY BEING PROCESSED
92	CL	1	REAL	THE COST LIMIT (AS SPECIFIED BY INPUT) USED
93				IN THE CONSTRAINED COST REQMT CASE.
94	CINT	1	REAL	TOTAL COST OF THE REQMT FOR THE UNCONSTRAINED
95	CNCS(I,J)	300	REAL	TOTAL COST OF REQMT FOR PART J USING
96	COST(I,J)	300	REAL	THE SPECIFIED PART REPLACEMENT POLICY.
97	CRNCS(J)	300	REAL	COST OF A SINGLE ITEM OF PART J. THIS IS
98				ALSO DENOTED AS "PART UNIT COST".
99	DCOST1(I,J)	120	REAL	THE UNCONSTRAINED COST SOLUTION REQMT FOR
100				PART J AT ANY STAGE OF THE PARTIAL SUB
101				REQUIREMENT CALCULATION ALGORITHM.
102	DCOST2(I,J)	120	REAL	THE TOTAL CUMULATIVE REQMT COST THRU DAY I
103				FOR THE FULL SUB PARTS ONLY. I.E., THIS IS
104				THE PORTION OF THE "CUM REQMT COST THRU DAY N"
105				ENTRY WHICH IS ASSOCIATED WITH THE FULL SUB
106				PART SET.
107	DCOSTF(I,J)	120	REAL	CUMULATIVE COST OF THE FULL REQUIREMENT
108				(ALL PARTS) THRU DAY I USING THE SPECIFIED
109				PART REPLACEMENT POLICY WITH UNCONSTRAINED
110				COST.
111				
112	DO004(J)	300	REAL	ARRAY STORING THE ATTRIBUTE TO BE SORTED ON
113				IN SUBROUTINE MAXC. IN MAIN PGH, THIS WAS PART
114				UNIT COST FOR PART J. IN SUBROUTINES CLIST &
115				UCROPS, THIS WAS THE AMOUNT OF THE SOLUTION
116				REQMT FOR PART J.
117				
118	ICOST	1	FIXED	INDICATOR WHICH TELLS SUBROUTINE UCROPS WHETHER
119				TO PRINT THE PARTS REQMTS LIST (0=DO 1=DON'T).
120				REQMTS LIST IS NOT PRINTED DURING CONSTRAINED
121				COST REQMT CALCULATIONS.
122				
123	ICCC(I,IND)	2	FIXED	STORES, FOR EITHER TOTAL(IND=1) OR RESIDUAL
124				(IND=2), THE LATEST DAY FROM THE "CUM COST
125				REQMT THRU DAY N" TABLE (FROM THE UNCONSTRAINED
126				COST CASE) FOR WHICH ASSOCIATED "CUM COST"
127				IS LESS THAN OR = THE INPUT-SPECIFIED COST
128				LIMIT USED IN THE CONSTRAINED COST CASE.
129				
130	IFSI(J)	300	FIXED	ARRAY STORING THE PARCON PART NUMBERS OF THE
131				PARTS IN THE FULL-SUB PART SET.
132	INSEL		FIXED	NUMBER OF PART TYPES FOR WHICH INDIV ITEM
133				"CUMULATIVE (UNCONSTRAINED COST) SOLUTION REQMTS
134				THRU DAY N" ARE DESIRED. (SEE SAI(I,J) &
135				IP(I,J) BELOW)
136	INT	1	FIXED	THE INTERVAL AT WHICH THE PARTIAL SUB
137				COMPUTATION ALGORITHM (ROUTINE UCROPS)
138				INCREMENTS VALUES FOR "ALLOWABLE NMCS ACFT".
139				AT EACH STAGE OF CALCULATION OF SEPARATE REQMT
140				SOLUTIONS FOR THE FULL-SUB SET AND THE NO-SUB
141				SET. ALWAYS SET=1 FOR RELIABLE RESULTS. ITS
142				VALUE IS SET =1 IN THE PROGRAM CODE.
143				
144	IPT(I,J)	5	FIXED	ARRAY STORING INTERNAL PART NRS (SUBSCRIPTS)
145				FOR PARTS FOR WHICH A CUMULATIVE DAY BY DAY
146				REQUIREMENT HISTORY IS TO BE PRINTED
147				
148	IRC(I,J)	300	FIXED	ARRAY CONTAINING PART NUMBERS ORDERED ACC TO
149				DECREASING PART UNIT COST FOR ASSOCIATED PART
150				

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164 C IRO(J) 300 FIXED ARRAY CONTAINING PART NUMBERS ORDERED ACC TO
165 DECREASING SOLUTION REQNT AMOUNT FOR ASSOCIATED
166 PART
167
168 C NP 1 FIXED NR OF PART TYPES PROCESSED IN RUN. (THIS
169 EXCLUDES PART TYPES WITH ESSENTIALITY CODE
170 =LE. IESS OR WITH A ZERO FAILURE RATE)
171
172 C NP1 1 FIXED TOTAL NUMBER OF 'PART NUMBERS' IN THE FULL-SUB
173 PART SET
174 C NP2 1 FIXED TOTAL NUMBER OF 'PART NUMBERS' IN THE NO-SUB
175 PART SET
176 C NW 1 FIXED LENGTH (DAYS) OF SCENARIO
177
178 C PTDEP(J,K) 300,24 REAL TOTAL AMOUNT OF INITIAL STOCK FOR PART J
179 RECEIVED AT THEATER (EXCLUDING IN-PLACE STOCK)
180 BETWEEN DAY 50K-4 AND DAY 50K
181
182 C OPA(J) 300 REAL THE 'QUANTITY PER APPLICATION' FOR PART J.
183 I.E. THE STANDARD NUMBER OF ITEMS OF PART J
184 INSTALLED ON EACH OPERATIONAL ACFT
185
186 C SM(J,J) 120,100 REAL THE CUMULATIVE (UNCONSTR COST) SOLUTION REQNT
187 THRU DAY I FOR PART IPT(J)
188
189 C SRMAX1(J) 300 REAL A WORKING VARIABLE USED IN THE CALCULATION OF
190 THE UNCONSTR COST REQNT FOR A PART J IN THE
191 FULL-SUB SET. IT IS THE RUNNING MAXIMUM (OVER
192 TIME) OF THE NET DEMAND (INCLUDING INITIAL STK)
193 FOR PART J THRU THE DAY BEING PROCESSED
194
195 C STK(J) 300 REAL INITIAL SERVICEABLE STOCK OF PART J. IT IS THE
196 SERVICEABLE WAR RESERVE + (IN-PLACE ASL/PLL
197 ON DAY 1)
198
199 C TSTK(J) 300 REAL THE CUMULATIVE STOCK DEPLOYED FOR PART J ON
200 THE DAY BEING PROCESSED
201
202 C
203 C
204 C
205 C
206 C
207 C
208 C
209 C
210 C
211 C
212 C
213 C
214 C
215 C
216 C
217 C
218 C
219 C
220 C
221 C
222 C
223 C
224 C
225 C
226 C
227 C
228 C
229 C
230 C
231 C
232 C
233 C
234 C
235 C
236 C
237 C
238 C
239 C
240 C
241 C
242 C
243 C
244 C
245 C
      DIMENSION
      * RMIN(300)
      COMMON
      * AC(120),      ACL,      ADESC(300),      ALLOW(1120),
      * ALL00(120),    AMSN(300),    ASURV(120),    AVG(6),
      * AVN(120),     B(120),     BF(300),     CASE,
      * COMD(300),    CP(300),    CRNCS(300),    CHIN,
      * CNC(300),     COST(300),   CRNCS(300),    OCOST(300),
      * DCOST(120),   DCT(300),   DF(300),     DNO(300),
      * D(120),       FMA(120),   FNM,        FNPAPD(3,120),
      * FRA(120),     ICOST,     IDC(12),    IFNC(1120),
      * IFSI(300),    IMSEL,     INS(300),    INT,
      * IPT(100),     IRC(300),   IR0(300),    ISWRT,
      * NP,          MP1,      NP2,        NW,
      * PTDEP(300,24), OPA(300),   RNC(120),    RNCS(300),
      * SM(120,100),  SRMAX1(300), STK(300),    SUMB(120),
      * TRNCS(300),   TSTK(300),   TSUMB,      CASE
      CHARACTER*16
      * ADESC,
      * DO 100 K=1,IMSEL
      *      DO 100 I=1,120
100 SM(I,K)=0,
      DO 200 J=1,NP
      TSTK4(J)=TSTK(J)
      RNCS1(J)=0,
      CRNCS1(J)=0,
      CONDAIJ(J)=0,
      200 SRMAX1(J)=999.
C
C INITIALIZE ACHIEVED DAILY STOCKOUTS FROM NO-SUB PARTS
C
      DO 300 I=1,NW
      ALLOW(1120)=ALLOW(1)
      DCOST(1120)=0.
      300 DCOST(1120)=0.
C
C THRU STMT 1600 COMPUTE THE UNCONSTR COST REQNTS SOLUTION. PROCESS
C ALL PARTS ON EACH SUCCESSIVE DAY
C
      DO 1600 I=1,NW
      I=I-1175+1

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296      TALLOW=ALLOWB(I).
297      CHINT=99999999999.
298      NA=ALLOWB(I)+1.5.
299      DO 400 J=1,NP
300      TSTM1(J)=TSTM1(J)+PTDEP(J,IA)/S.
301      RMIN(J)=0.
302      ZINT=INT
303      IADD=0
304      IF (MOD(NA-1,INT).NE.0) IADD=1
305      MULT=((NA-1)/INT)+IADD
306      MAD=MULT*INT+1
307      LAST=0
308
309      C THRU STMT 1500, COMPUTE REQMTS AND COSTS SEPARATELY FOR THE FULL-SUB
310      C AND THE NO-SUB PART SETS FOR ALL COMBINATIONS I1,I2 WITH I1+I2=
311      C ALLOWED NMCS ACFT FOR DAY I1 + 1
312      C
313      DO 1500 L1=1,MAD,INT
314      L2=MIND(I1,NA)
315      I1=I1-1
316      I2=NA-I1-1
317      ALLOW1112=I2
318
319      C IF THERE ARE NO FULL-SUB PARTS, SKIP FULL-SUB PROCESSING
320      IF (NP1.EQ.0) GO TO 700
321
322      C THRU STMT 600 , DO REQMT CALCULATIONS ON THE FULL-SUB PART SET
323
324      DO 600 JA=1,NP1
325      J=IFS1(JA)
326      IF (I12.GT.1) GO TO 500
327      CDMDA=CDMDA(J)
328
329      C COMPUTE NET DEMAND FOR PART J BASED ON INTT STM=0 THEN ADJUST(XXX)
330      C FOR DISTRIBUTED STOCK
331      CDMDA1(J)=SR(S1,J,CDMA)
332      XXX=CDMDA1(J)
333      IF (I1D.EQ.2) XXX=XXX-TSTM1(J)
334      IF (XXX.GE.SRMAX1(J)) SRMAX1(J)=XXX
335
336      C COMPUTE THE DAY REQMT
337      CRNCS1(J)=AMAX1(0.,SRMAX1(J))
338      GO TO 600
339      500      IF (I11.GE.NA) ZINT=NA-LAST
340
341      C WHEN THE ALLOWED NMCS ACFT IS INCREASED BY INT, THEN THE REQMT FOR
342      C A PART IS REDUCED BY INT*QPA. (INT=1 AS SET IN THE MAIN PROGRAM)
343      CRNCS1(J)=AMAX1(0.,CRNCS1(J)-ZINT*QPA(J))
344
345      C CALC REQMT FOR EACH PART J OF THE FULL-SUB PART SET, THRU THIS COMBINATION
346      C OF I1 & I2, AS THE MAX OF THE DAY REQMTS (FOR THE PART) OVER ALL DAYS PROCESSED
347      600      CRNCS1(J)=AMAX1(CRNCS1(J),CRNCS1(J))
348
349      C CALL THE NO-SUB REQMTS CALCULATION ROUTINE TO OPERATE ON THE NO-SUB
350      C PART SET
351      700      IF (NP2.GT.0) CALL NCRNC (I,I2,IND)
352      TOTC=0.
353
354      C CALCULATE TOTAL REQMTS COST FOR THIS COMBINATION OF I1,I2
355
356      DO 800 J=1,NP
357      800      TOTC=TOTC+COST(J)*CRNCS1(J)
358      IF (TOTC.GE.CHINT) GO TO 1000
359      TALLOW=I2
360      CHINT=TOTC
361
362      C USE ONLY THR REQMTS FROM THE "CHEAPEST" COMBINATION OF I1 & I2
363
364      DO 900 J=1,NP
365      900      RMIN(J)=CRNCS1(J)
366      1000      IF (I12.NE.NA.AND.NP1.NE.0) GO TO 1400
367
368      C ASSUMING THERE ARE SOME FULL-SUB PARTS IN THIS POLICY, DON'T DO
369      C FINAL CALCULATIONS UNLESS ALL COMBINATIONS HAVE BEEN CHECKED
370
371
372
373
374
375
376
377

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328      C COMPUTE THE FINAL REQMT FOR EACH PART AS THE LARGEST OF THE PART
329      C REQMTS FOR THE "CHEAPEST" COMBINATIONS OF I1 & I2
330      C
331      DO 1200 J=1,NP
332      RNC5(J)=AMAX1(RMIN(J),RNC5(J))
333
334      C COMPUTE "CUM REQMT COST (ALL PARTS) THRU DAY I"
335      C
336      DCOSTF(I)=DCOSTF(I)+RNC5(J)*COST(J)
337
338      C STORE "CUM REQMT THRU DAY N" FOR THE PARTS SPECIFIED IN INPUT
339      C
340      DO 1100 M=1,IMSEL
341      IF (J.EQ.IPT(M)) SM(I,M)=RNC5(J)
342      CONTINUE
343      1200  CNCS(J)=COST(J)*RNC5(J)
344      IF (INP1.EQ.0) GO TO 1600
345
346      C STORE "CUM REQMTS COST THRU DAY I" FOR JUST THE FULL-SUB PARTS IN THE
347      C TOTAL(ALL PARTS) REQMT
348      C
349      DO 1300 J=1,NPI
350      II=IF5(J)
351      DCOST1(I)=DCOST1(I)+RNC5(II)*COST(II)
352      IF (INP1.EQ.0) GO TO 1600
353      1500  LAST=L2
354
355      C SET ALLOWABLE NMCS ACFT FOR THE DAY JUST PROCESSED TO THE VALUE OF
356      C I2 USED IN COMPUTING THE SOLUTION REQMT FOR THAT DAY
357      C
358      ALLOW1(I)=TALLOW
359      1600  CONTINUE
360      IF (ICOST.EQ.1) RETURN
361
362      C PRINT THE TOTAL REQMT COST
363
364      WRITE (6,2800) CASE
365      IF (IND.EQ.1) WRITE (6,2900)
366      IF (IND.EQ.2) WRITE (6,3000)
367      IF (ICOST.EQ.1) WRITE (6,3100) CL,ACL,IDCC(IND)
368      WRITE (6,3200)
369      WRITE (6,3300) CMINT
370      IF (ICOST.EQ.1) RETURN
371      IF (IORD.LE.0) GO TO 1900
372      IF (ICOST.EQ.1) RETURN
373      IF (IOP74.LE.0.AND.ICOST.EQ.0) GO TO 2200
374
375      C IF IORD .GT. 0 ORDER THE REQMTS ACC TO DECREASING AMOUNT OF REQMT
376      C
377      DO 1700 I=1,NP
378      IRO(I)=0
379      1700 DOD(I)=PNCS(I)
380      NOUNNY=NP
381      DO 1800 K=1,NP
382      CALL MAXC (NOUNNY,NOUT)
383      IRO(K)=NOUT
384      II=IRO(K)
385      1800 DOD(II)=-1.
386
387      C PRINT THE LIST OF REQMTS FOR ALL PARTS
388      C
389      1900 DO 2100 I=1,NP
390      II=IRO(I)
391      IF (IORD.LE.0) II=IRC(I)
392      IF (MOD(I-1,50).NE.0) GO TO 2000
393      WRITE (6,2800) CASE
394      IF (IND.EQ.1) WRITE (6,3400)
395      IF (IND.EQ.2) WRITE (6,3500)
396      WRITE (6,3600)
397      IF (ICOST.EQ.1) WRITE (6,3100) CL,ACL,IDCC(IND)
398      WRITE (6,3600)
399      WRITE (6,3800)
400      WRITE (6,3600)
401      2000  TC=100.*RNC5(II)/(CMINT*.000001)
402      2100  WRITE (6,3900) I,II,AMSN(I),ADESC(II),RNC5(II),CNCS(II),TC
403      2200  IF (ICOST.EQ.1) RETURN
404      ICOST=1
405      IF (IOP75.LE.0) GO TO 2500
406
407      C PRINT THE TABLE OF "CUM REQMT THRU DAY N" FOR THE (UP TO 100) PARTS
408      C SPECIFIED IN INPUT
409

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410      NN=IMSEL/5
411      IF (MOD(IMSEL,5).NE.0) NN=NN+1
412      IF (NN.GT.20) NN=20
413      DO 2400 L=1,NN
414          M1=IPT(1+(L-1)*5)
415          M2=IPT(2+(L-1)*5)
416          M3=IPT(3+(L-1)*5)
417          M4=IPT(4+(L-1)*5)
418          M5=IPT(5+(L-1)*5)
419          DO 2300 I=1,NW
420              IF (MOD(I-1,50).NE.0) GO TO 2300
421              WRITE (6,2800) CASE
422              IF (IND.EQ.1) WRITE (6,4000)
423              IF (IND.EQ.2) WRITE (6,4100)
424              WRITE (6,3600)
425              WRITE (6,4200) M1,M2,M3,M4,M5
426              WRITE (6,3600)
427              WRITE (6,4300) AMSN(M1),AMSN(M2),AMSN(M3),AMSN(M4),AMSN(M5)
428              WRITE (6,4300) ADESC(M1),ADESC(M2),ADESC(M3),ADESC(M4),ADESC(M5)
429              WRITE (6,4400)
430              WRITE (6,3600)
431              WRITE (6,4400)
432              2300  WRITE (6,4500) (I,SM(I,K+(L-1)*5),K=1,5)
433              2400  CONTINUE
434              2500  IDCC(IND)=0
435
436      C PRINT THE TABLE OF "CUM REQTS COST THRU DAY N"
437      DO 2700 I=1,NW
438          IF (MOD(I-1,50).NE.0) GO TO 2600
439          WRITE (6,2800) CASE
440          IF (IND.EQ.1) WRITE (6,4600)
441          IF (IND.EQ.2) WRITE (6,4700)
442          WRITE (6,3600)
443          WRITE (6,4800)
444          2600  IF (DCOSTF(I).GT.CL) GO TO 2700
445          IDCC(IND)=1
446          ACL=DCOSTF(I)
447          2700  WRITE (6,4900) I,DCOSTF(I)
448          WRITE (6,3100) CL,ACL
449          WRITE (6,3150) IDCC(IND)
450
451      RETURN
452      FORMAT (1H1,10X,*CASE= ",A16)
453      FORMAT (/,1X,*TOTAL(INIT STK=0) COST OF RQMTS")
454      FORMAT (/,1X,*RESIDUAL(INIT STK=CURR STK) COST OF RQMTS")
455      FORMAT (//,10X,*COST LIMIT OF ",F12.0, APPROXIMATED BY ",F12.0)
456      FORMAT (//,10X,*WHICH IS THE CUM RQMT COST THRU DAY",I4)
457      FORMAT (/,10X,*POLICY ",TOT COST")
458      FORMAT (/,10X,*PART SUB",F14.0)
459      FORMAT (/,30X,*TOTAL(INIT STK=0) STK RQMTS ")
460      FORMAT (/,30X,*RESIDUAL(INIT STK=CURR STK) STK RQMTS ")
461      FORMAT (/,10X,*PART NR",17X,*PART",21X,*RQMT",7X,*COST &COST")
462      FORMAT (2X,I5,I10,5X,A16,2X,A16,F8.1,F12.0,F6.2,F4X)
463      FORMAT (/,42X,*CUM TOTAL RQMT(INIT STK=0) REQUIRED THRU GIVEN DAY")
464      FORMAT (/,42X,*CUM ADD-ON RQMT(INIT STK=CURR INV) REQUIRED ",*THRU
465      * GIVEN DAY")
466      FORMAT (13X,5(6X,*PART NR",I5,6X))
467      FORMAT (13X,5(A16,8X))
468      FORMAT (15X,*DAY",21X,*DAY",21X,*DAY",21X,*DAY",21X,*DAY")
469      FORMAT (8X,5(I10,F8.1,6X))
470      FORMAT (/,2X,*CUM TOTAL(INIT STK=0) COST OF REQ THRU GIVEN DAY")
471      FORMAT (/,2X,*CUM RESIDUAL(INIT STK= CURR STK) COST OF REQ THRU",
472      * GIVEN DAY")
473      FORMAT (/,6X,*DAY",3X,*PART SUB")
474      FORMAT (6X,I3,3X,2F11.0)
475
476      END
477

```

```

82      C      CONSTRAINED COST ADD-ON REOMT) IS STOCKED.
83      C      THIS IS RECURSIVELY COMPUTED.
84
85      C      COMMON
86      C      * AC(120),   ACL,      ADESC(300),  ALLOW1(120),
87      C      * ALLOW8(120),  AMSN(300),  ASURV(120),  AVAV6(6),
88      C      * AVH(120),   BCY(300),  BF(300),    CASE,
89      C      * CDMDA(300),  CF(300),   CL,        CMIN,
90      C      * CNC5(300),   COST(300),  CRNCS(300),  DCOST(300),
91      C      * DCOSTF(120),  DCY(300),  DF(300),   DMD(300),
92      C      * DOD(300),   FMA(120),  FMM,       FHPAPD(3,120),
93      C      * FHR(120),   ICOST,    IDC(2),     IFHC(120),
94      C      * IFS(300),   IMSEL,    INS(300),  INT,
95      C      * IPT(100),   IRC(300),  IRO(300),  ISHORT,
96      C      * NP,        NPI,      NP2,       NW,
97      C      * PTDFP(300,24), QPA(300),  RNC(120),  RNCS(300),
98      C      * SM(120,100),  SRMAX1(300), STK(300),  SUMB(120),
99      C      * TRNCS(300),   TSTK(300),  TSUMB
100     C      CHARACTER*16
101     C      ADESC,      ADSC,      AMSN,      CASE
102     C
103     C      CALC (ID,IB) THE DAYS ON WHICH 'ITEMS RETURNING TODAY(DAY I)
104     C      FROM DEPOT' FAILED.
105     C
106     C      ID=I-DCY(J)
107     C      IB=I-BCY(J)
108     C      DRR=0.
109     C      BRR=0.
110     C
111     C      CALC (DRR) RETURNING REPAIRS(RETURNING ON DAY I)FROM DEPOT AND
112     C      CALC (BRR) RETURNING REPAIRS FROM RETAIL. THEN DETERMINE CUMULATIVE
113     C      NET DEMAND (THRU TODAY(DAY I)) BY ADD NET DEMANDS GENERATED
114     C      TODAY TO CUMULATIVE NET DEMANDS THRU YESTERDAY,
115     C
116     C      IF (ID.GT.0) DRR=DF(J)*FHA(ID)
117     C      IF (IB.GT.0) BRR=BF(J)*FHA(IB)
118     C      SR=CDMD*CF(J)*FHA(I)-DRR-BRR
119     C      RETURN
120     C      END

```

APPENDIX B

REFERENCES

1. Aircraft Spares Stockage Methodology (Aircraft Spares) Study, CAA-SR-84-12, US Army Concepts Analysis Agency, April 1984
2. Overview/PARCOM Turnkey Project (OPTP), CAA-SR-84-33, US Army Concepts Analysis Agency, November 1984
3. Parts Requirements and Cost Model (PARCOM) User's Guide, CAA-D-84-10, US Army Concepts Analysis Agency, October 1984
4. Parts Requirements and Cost Model (PARCOM) Functional Description, CAA-D-84-15, US Army Concepts Analysis Agency, October 1984
5. Partial Substitution and other Modifications to the PARCOM Model, CAA-TP-84-11, US Army Concepts Analysis Agency, November 1984
6. Extended Parts Requirements and Cost Model (PARCOM) User's Guide, CAA-D-85-2, US Army Concepts Analysis Agency, March 1985

GLOSSARY

ABBREVIATIONS, ACRONYMS, AND SHORT TERMS

acft	aircraft
AF	allowed stockouts over the full-sub part set
AFH	achievable flying hours
AFLC	Air Force Logistics Command
AMC	US Army Materiel Command
AN	allowed stockouts over the no sub part set
AR	Army regulation
ASL	authorized stockage list(s)
avail	availability
avg	average
AVIM	aviation intermediate maintenance
AVSCOM	US Army Aviation Systems Command
AVUM	aviation unit maintenance
BC	retail (base) condemnation rate
BR	retail repair time
CAA	US Army Concepts Analysis Agency
calc	calculation(s)
CCSS	Commodity Command Standard System
CONUS	Continental United States
cont	continued
cum	cumulative
curr	current
DC	depot condemnation rate

CAA-D-85-3

DCSLOG US Army Deputy Chief of Staff for Logistics
DESCOM US Army Depot Systems Command
dmd demand
DOD Department of Defense
DRT depot repair time
EFH estimated flying hours
est estimated
FH flying hour(s)
FHP flying hour program
fly hr flying hour
FS full sub (phase)
full sub full substitution (replacement policy)
hr hour
init initial
MFHAD maximum flying hours per aircraft per day
min minimum
MSC major subordinate command
NMC not mission capable
NMCS not mission capable (due to) supply
no sub no substitution (replacement policy)
NS no sub (phase)
NRTS not repairable (at) this station
OPTP Overview/PARCOM Turnkey Project
OST order and ship time
PARCOM Parts Requirements and Cost Model
pgm (flying hour) program

Glossary-2

PLL prescribed load list(s)
pt part
ret returning (repairs)
QPA quantity per application
rqmt(s) requirement(s)
sub substitution

END

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